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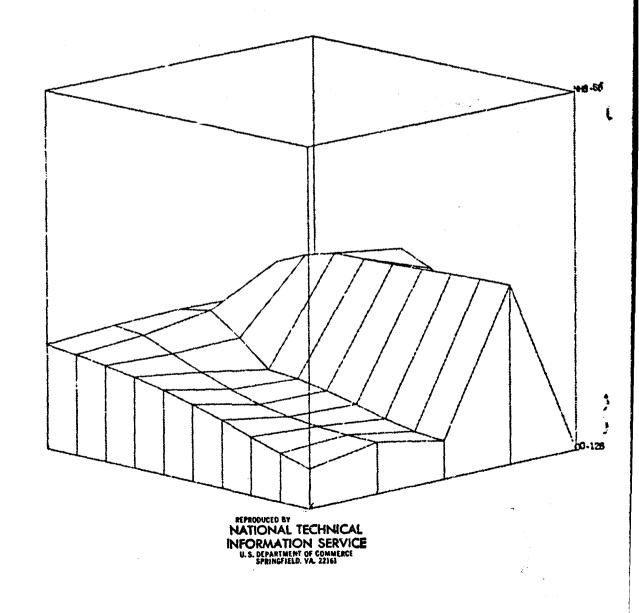
Computer Programs in Marine Science

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

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April 1976



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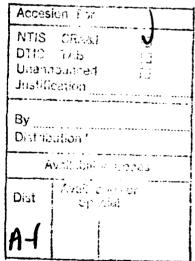
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KEY TO OCEANOGRAPHIC RECORDS DOCUMENTATION NO. 5 Computer Programs in Marine Science

Compiled by Mary A. Firestone

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







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INTRODUCTION

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> 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 charged 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 rot 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 Fublic Printer U. S. Govennment 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. ""rientific 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 type 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, 97C3 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 i ¹⁷ George T. Heimerdinger Nelson C. Ross John Sylvester Robert W. Taber Rosa T. Washington Judith Yavner Thomas Yowell

Oceanographic Unit Cashington, DC) Corpus Christ. T.: U. S. Department of Trausportation: U. S. Department of the Interior: Geological Survey: National Center (Reston, VA) Environmental Protection Agency: Ice Patrol (New York, ...) Other Federal Agencies Menlo Park, CA Woods Hole, N **Gulf Breeze, FL** Coast Guard: Contributors to "Computer Programs in Marine Science" Naval Undersea Renearch and Development Center (San Diego, CA) Naval Electronics Laboratory Naval Undersea Center (Pasadena, CA) Coastal Engineering Research Center Defense Mapping Agency Hydrographic Center (Washington, DC) (New London, CT, and Newport, RI) Fleet Numerical Weather Central (Monterey, CA) Naval Underwater Systems Center Naval Surface Weapons Center Naval Academy (Annapolis, MD) Civil Engineering Laboratory Naval Oceanographic Office U. S. Department of Defense Naval Postgraduate School Naval Research Laboratory Fleet Weather Facility Department of the Army: Department of the Navy: (Silver Spring, MD) (Port Hueneme. CA) (Washington, DC) (Washington, DC) (San Diego, CA) (Monterey, CA) (Suirland, MD) Wational Oceanographic Data Center National Geophysical and Solar-Environmental Research Laboratories: Techniques Development Laboratory Center for Experiment Design and National Marine Fisheries Service: Data Analysis National Environmental Satellite National Oceanic and Atmospheric Meteorological Luboratories Pacific Marine Environmental Southwest Fisheries Center: U. S. Department of Commerce Southeast Fisherics Conter Atlantic Oceanographic and Terrestrial Data Center Environmental Data Service: National Weather Service: La Jolla Laboratory Honolulu Laboratory National Ocean Survey Administration Laboratory Service

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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.

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Pacific Biological Station Fisheries Research Board of Canada IBM 1620 only - above report) P. O. Box 100 Nanaimo, B. C. V9R 5K6

Copy on file at NODC (FORTRAN I version for

STD Computations STT02

Language - FORTRAN IV Hardwale - IBM 1130

Computes derived oceanographic quantities for Bisset-Berman STD casts. Printed output: Pressure, temperature, salinity, depth, sigma-t, specific volume anomaly, potential cemperature 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 Copy on file at NODC (above report) Fisheries Research Board of Canada P. O. Box 100 Nanaimo, B. C. V9R 5K6

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

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, an. the STD data. Technical report No. 152 (unpublished manuscript), by A. Huyer and C.A. Colli.s, Dec. 1969. (See program WET, next page)

> Pacific Biological Station Copy on file at NODC (above report) Fisheries Research Los d of Canada P. O. Box 200 Nanaimo, B. (. VJR 5K6

STD Processing WET Language - FORTRAN 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
 Ccpy on file at NOBC (above report)

 Fisheries Research Board of Canada
 P. O. Box 100

 Naraimo, B. C. V9R 5K6
 V9R 5K6

Station Data Retrieval HYDROSEARCH Language - ALGOL 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, Ls Jolls, 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 ISALBP

t

Language - FORTRAN II Hardware - CDC 3100

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

Oxygen Saturation, Oxygen Anomaly ISATBP

Language - FORTRAN II Hardware - CDC 3100

Calculates the percentage of oxygen saturation in seavater, 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).

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Available from originator only

Plot Theta-S Curves

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

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.

A SAME AND A DESCRIPTION OF A DESCRIPTIO

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

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

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

Telephone (902) 426-3676

STD Tables and Plots STD

Language - FORTRAN IV Hardware - Hi 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 Available from originator only Bedford Institute of Oceanography P. O. Box 1006 Dartmouth, N. S. B2Y 4A2

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
 Available from originator only Lopez Ambrosioni

 Centro Argentino de Datos Oceanograficos

 Avenida Montes de Oca 2124

 Buenos Aires, Republica Argentina

 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
 Available from originator only

 Lopez Ambrosioni
 Centro Argentino de Datos Oceanograficos

 Avenida Montes de Oca 2124
 Euenos Aires, Republica Argentina

 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

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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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 Centro Argentino de Datos Oceanograficos

 Avenida Montes de Oca 2124

 Busnos Aires, Republica Argentina

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	Available from originator only
580 Booth Street	
Ottawa, Ont. KlA OH3	Telephone (613) 995-2011

Data Management System for Physical	Language - COBOL, FORTRAN, PL/1, machine lang.
and Chemical Data	Hardware - CDC 6400 under SCOPE 3.3, 125K octal
OCEANS V	words/IBM 360-85 under MVT, 200K decimal bytes

The OCEANS V system is designed to make available any physical, chemical, or meteorological

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data collected as manual recordings or analog traces. The system is divided into a number of modules and presently processes data collected using Namren bottles and mechanical bathythermogr phs. 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. KLA OH3	Telephone (613) 995-2011

Mass Transport and Velocities GEOMASS

Language - FORTRAN II 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 TWIRP Language - FORTRAN IV 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
Marine Sciences Department	
University of Puerto Rico	
Mayaguez, FR 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

4

Language - FORTRAN IV Hardware - Burroughs 6700/2125 words

only

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 Geofísica Universidad N.A. de Mexico Ciudad Universitaria Mexico 20, D.F. Copy on file at NODC

Telephone 548-63-00, ext. 537

Flexible System for Biological, Physical, and Chemical Data SEDHYP (System d'Exploitation des Donnees en Hydrologie Profonde) Language - FORTRAN JV 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	Available from originator only
des Oceans	
Boite Postale 337	
29273 Brest Cedex, France	Telephone 80.46.50, telex. 94-627

Subroutines for Physical, Chemical and Biological Parameters CO4 SAL, C44 TETA, C 46 SIGM 2, 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 ide tification number of the chosen method. Documentation: "Catalogue des mathodes de calcul des arameters physiques, chimiques et biologiques," Dec. 1973.

Nr. Stanislas, BNDO Avsilable from originator only Centre National pour l'Exploitation des Oceans Boite Postale 337 29273 Breat Cedex, France Telephone 80.46.50, telex 94-627

Interiolation Subroutines INTERP1, INTERP2, etc. Language - FORTRAN IV Hardware - XDS Signa 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
 Ava

 Centre National pour l'Exploitation des Oceans
 Boite Postale 337

 29273 Brest Cedex, France
 Tel

Available from originator only

Telephone 80.46.50, telex 94-627

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

Language - FORTRAN IV Hardware - XDS Sigms 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 va. 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	Available from originator only
Centre National pour l'Exploitation	
des Oceans	
Boite Postal 337	
29273 Breat Cedex, France	Telephone 80.46.50, telex 94-627

Reads, Calculates, Interpolates Station Data CATRICORN

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 signs thets surfaces or potential temperatures. (See subroutines F3, SECPG, EDIT, and PLTEDT.)

Ruth McMath	Available from originator only
Department of Oceanography	
Texa: A6M University	
College Station, TX 77843	Telephone (71!) 845-7432
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Station Data Calculations F3 Language - FORTLAN 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 (decending 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 Lasis for much of the present version. (See program CAPRICORN.)

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Ruth McMath Department of Oceanography Texas A&M University College Station, TX 77843 Available from originator only

Telephone (713) 845-7432

Plots Station Data PLTEDT

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Language - FORTRAN IV 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 SECPG

Language - FORTRAN IV 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, signs 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 HYD2 Language - HP ASA Basic FORTRAN 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 OBVFRO Language - FORTRAN IV 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.

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Information Processing Center Woods Hole Oceanographic Institution Woods Hole, MA 02543 Available from originator only

Telephone (617) 548-1400

Dynamic Height DYNHT

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Language - FORTFAN IV Hardware - XDS Sigma 7/85 words

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

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Jacqueline WebsterAvailable from originator onlyWoods Hole Oceanographic InstitutionTelephone (617) 548-1400

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

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

Jacqueline WebsterAvailable from originator onlyWoods Hole Cceanographic InstitutionTelephone (617) 548-1400

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

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
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 Woods Hole Oceanographic Institution
 Telephone (617) 548-1400

Specific Volume Anomaly SVANOM Language - FORTRAN IV-H Herdware - XDS Signa 7

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

Mary HuntCopy on file at NODC (listing, documentation)Woods Hole Oceanographic InstitutionTelephone (617) 548-1400

Pressure Subroutine PRESS

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Language - FORTRAN IV-H Hardware - XDS Sigma 7

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

 Mary Hunt
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 Woods Hole Oceanographic Institution
 Telephone (617) 548-1400

Reads Station Data DATA Language - FORTRAN IV-H 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
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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
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 Woods Hole Oceanographic Institution
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Volume Transport VTR Language - FORTRAN IV-H Hardware - XDS Sigma 7

Computes volume transport between two stations.

Mary HuntAvailable from originator onlyWoods Nole Oceanographic InstitutionWoods Hole, MA 02543Telephone (617) 548-1400

Sigma-t SIGMAT and DSIGMT Language - FORTRAN IV-H 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
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 Woods Hole Oceanographic Institution
 Telephone (617) 548-1400

Adiabatic Temperature Gradient ATG Language - FORTRAN IV-H 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
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 Woods Hole Oceanographic Institution
 Woods Hole, MA 02543

 Telephone (617) 548-1400

Potential Temperature POTEMP

Language - FORTRAN 1V Hardware - XDS Sigma 7/100 words

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

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Specific Volume SPVOL

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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
 Available from originator only

 Woods Hole Oceanographic Institution
 Woods Hole, MA 02543

 Telephone (617) 548-1400

Oxygen OPLOT Language - FORTRAN IV Hardware - CDC 3300

Computes oxygen in m1/1 and percent saturation.

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U.S. Coast Guard Oceanographic Unit Available from originator only Bldg. 159-E, Navy Yard Annex Washington, DC 20590 Telephone (202) 426-4642

Chlorophyl CHLO Language - FORTRAN IV Hardware - CDC 3300

Computes chlorophyl in mg/l.

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SalibityLanguage - FORTRAN IVSALTYHardware - CDC 3300

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

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Temperature-Salinity Class Volume TSVOL

Language - FORTRAN IV Hardware - CDC 3300

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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.

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Thermometer Correction THERZ	Language ~ FORTRAN IV Hardware ~ CDC 3300
for unprotected thermometers, lists bad ther	ng calibration factors; computes thermometric depth mometers and their malfunctions, computes observed a L-2 c and picks from the L-2 curve the d pths for
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Washington, DC 20590	Telephone (202) 426-4642
Transport XPORT	Language - FORTRAN IV Hardware - CDC 3300/CalComp Plotter
ume flow, current velocity at top of each so heat, heat and salt transport, net volume fi	idal values of average temperature and salinity vol- plenoid, distance (n.m.) between stations, specific low for each pair of stations, net volume flow in sation and plots solenoid graph on off-line plotter.
U.S. Coast Guard Oceanographic Uni Bldg. 159-E, Navy Yard Annex	It Available from originator only
Washington, DC 20590	Telephone (202) 426-4642
Plots Temperatures, Lists Mixed Layer Depthe WEEKPLOT	s Language - FORTRAN Hardware - Burroughs 6700/Less than 20K words/ CalComp Plotter
computes and lists mixed layer depths. Mixed	ngles for the eastern tropical Pacific Ocean; also, ed layer depths are computed by an empirical for- tuna fishing vessels. Input: Disk files of synop- separately from punched cards.
A.J. Good	Available from originator only
Southwest Fisheries Center National Marine Fisheries Service	, NOAA
P.O. Box 271 La Jolla, CA 92037	Telephone (714) 453-2820, ext. 325
Constants for Harmonic Synthesis of Mean Se Temperatures, HARMONIC	a Language - ALGOL Hardware - Burroughs 6700/Less than 30K words/ Disk input and output
	nic synthesis of mean sea temperatures, by one-de- an sea temperature are treated by a Fourier series egree quadrangles for the Pacific Ocean.
A.J. Good Southwest Fisheries Center	Available from originator only
National Marine Fisheries Service P.O. Box 271 La Jolla, CA 92037	, NOAA 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 salini	ty sections from STD magnetic tape on 30-inch-wide

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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 Jolis, C' 92037 Telephone (714) 453-2820

Converts STD Data RDEDTP Language - FORTRAN 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. Pish 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

Corrects STD Data TPMOD Language - FORTRAN Hardware - CDC 3500/10K 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
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 Southwest Fisheries Center
 National Marine Fisheries Service, NOAA

 P.O. Box 271
 La Jolla, CA 92037

Telephone (714) 453-2820

Environmental Dynamics Subfoutines OCEANLIB Language - BASIC 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. SICMAT 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 seawster, using empirical formulas developed by LaFond and others. SOUND computes sound velocity using the empirical formula developed by LaFond 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. BarneyAvailable from originator onlyEnvironmental Sciences DepartmentU.S. Naval AcademyAnnapolis, MD 21402Telephone (301) 267-3561

Geostrophic Current CURRENT Language - BASIC 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.

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

Monthly Sonic Layer Depthh

Language - FORTRAN Hardware - IBM 7074

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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	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	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	Available from originator only
U.S. Naval Oceanographic Office	_
Washington, DC 20373	Tele phone (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 coefficiencs, 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	Available from originator only
U.S. Naval Oceanographic Office	-
Washington, DC 20373	Telephone (202) 433-3878

Oceanographic Data Computation TPCONV

Language - FORTRAN EXTENDED Hardware - CDC 6500/15K 6C bit words/Two tape units

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Assembles tem, erature, 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	Available from originator only
Code 14 San Diego, CA 92132	Telephone (714) 225-6243

Variance and Standard Deviation SUMMARY

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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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	John J. Russell Naval Undersea Center	Available from originator only
	Code 14 San Diego, CA 92132	Telephone (714) 225-6243
Sigma-T		Language - ANSI FORTRAT

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	Available from originator only
Naval Underwater Systems enter Newport, RI 02840	Telephone (401) 841-3307

STD Processing OCEANDATA

INVRE.I

Language - ANSI FORTRAN Hardware - CDC 3300/UCC plotter

Hardvare - CDC 3300

Converts raw Plessey CTD-STD data (frequency or period average) to parametric form, corrects salini'y 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 aviilable.

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K. Crocker	Available from priginator only
Naval Underwater Systems Center Newport, RI 02840	Telephone (401) 841-3307

Internal Waves

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

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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. Nata 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	Available from originator only
Naval Underwater Systems Center Newport, RI 02840	Telephone (401) 841-4772

Interpolation for Oceanographic Data

Language - FOPTRAN Hardware - CDC 3200/IBM 1620 Interpolates the values of depth, temperature, and salinity at isentropic livels (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, is 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	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	Telephone (203) 442-0771, ext. 2834

 Thermometric Depth Calculation
 Language - HP FORTRAN IV under RTE

 CAST
 Hardware - HP 21005/12K words core/10K for kTE/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 Available from originator only Shipboard Computing Group, Code 8003 Naval Research Laboratory Washington, DC 20375 Telephone (202) 767-2024

Thermometer Data File Handler THERMO Language - HP FORTRAN IV under RTE Hardware - HP 21.005/12K words core/10K for RTE

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

> J. Dean Clamons Available from originator only Shipboard Computing Group, Ccde 8003 Naval Research Laboratory Washington, DC 20375 Telephone (202) 767-2387

Internal Gravity Waves DISPER Language - FORTRAN Hardware - CDC 3800

Calculates frequency - wavenumber dispersion relations for internal gravity wave rodels. 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 Octan 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 the sients are identified and their key points are included in the information data printout. 'Sjective Digital Analysis of Bathythermograph Traces," thesis by Eric F. Grosfils, Pec. 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	Available from originator only
Center for Experiment Design and	
Data Analysis, NOAA/EDS	
Washington, DC 20.35	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 densitystratified 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 ACML's UNIVAC 1108.

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

Available from originators only

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.

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NOAA/EDS Washington, DC 20235	Telephone (202) 634-7439

Potential Temperature and/or Density Language - Assembler POTDEN Hardware - IBM 360-65/50K bytes

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

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SIGMAT

SALINE

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

Computes signa-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.

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Dynamic Depth Anomaly DYANOM	Language - FORTRAN 1V-G Hardware - 1BM 360-65
Subroutine computes dynamic depth anomaly.	Author ~ Robert Van Wie.
Oceanographic Services Branch National Oceanographic Data Center NOAA/ZDS	Copy on file at NODC
Washington, DC 20235	Telephone (202) 634-7439

Language - FORTRAN Hardware - 1BM 360-65 Computes Salinity from Conductivity, T, P

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 Telephone (272) 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 Telephone (202) 634-7439

Potential Temperature, Potential Density PODENS

Language - FORTRAN IV-G Hardware - 1EM 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 Telephone (202) 634-7439

Volume Transport VOLTRN Language - FORTRAN IV Hardware - I5M 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 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. Copy on file at NODC National Oceanographic Data Center NOAA/EDS Washington, DC 20235 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	Copy on file at NODC
SOAA/EDS Washington, DC 20235	Telephone (303) 634-7439

RSMAS Data Processing and Analysis	Language - FORTRAN*
Programs; Data Management System (D	MS) 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)

DNSCHP 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 PCN 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 gtid. (UNIVAC)

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

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

TIDE54 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)

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

(*Reading and writing DNS 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 ...ami 10 Rickenbacker Causeway Miami, FL 33149

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Available from originator only

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Telephone (305) 350-7546

CHEMISTRY

CO2 and D.O. SAT

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

Calculates percent saturation of dissolved oxygen and concentration of free CO₂. Follows standard methods (American Public Health Association, 1971) for oxygen and Garrels and Christ (1965) for CO₂ ("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, KJ, and free CO₂. "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

Telephone (902) 426-3676

Available from originator only

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 meeded 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 Postgraduath 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 calcuisted from the given oxygen content and the computed oxygen solubility. The same procedure is used to ascertain the minirum 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 U.S. Geological Survey National Center Reston, VA 22092 Copy on file at NODC (listing, Jocumentation)

Telephone (703) 860-7106

Water Chemistry - Dielectric Constant MO101 Language - FORTRAN IV 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 eac; of the 42 reactions along with activity product/equilibrium constant ratios for the hydrolysis reactions.

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

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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.

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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, GA 93940 Available from originator only

Telephone (408) 646-2937

Single Large Hydrodynamical-Numerical Model Language - FORTRAN IV Hardware - CDC 6590/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 H. Rabe
 Available from originator only

 Research Facility Environmental Prediction

 Naval Postgraduate School

 Monterey, CA 93940

Telephone (408) 646-2842

Estuarine Model NONLNRA Language - FORTRAN Hardware - IBN 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 Available from originator only Center for Marine and Cosstal Studies North Carolina State University Raleigh, NC 27607 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 cstuary 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 valinities by tidal cycle; (3) longitudinal dispersion coefficients; (4) plots. Technical Report No. 15^o, "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	Available from MIT or from the suthor.
Southampton College Southampton, NY 11968	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 Available from originstor only University of Delaware P.O. Box 2826 Leves, DE 19958 Telephone (302) 645-6674

Beach Simulation Model

Language - FORTRAN IV Haidware - 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," Willies College.

William T. Foy	Available from originator only
Department cl Geology	
Williams College	
Williamstown, MA 01267	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, identifier 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 Ocean Engineering Program Oregon State University Corvallis, OR 97331 Available from originator only

Telephone (503) 754-3631

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

Provides signa-t and three velocity component profiles as a function of two space variables for a steady-state, two-dimensional unwelling. 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 liardware - 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.

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

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. Michael Amein Department of Civil Engineering North Carolina State University Raleigh, NC 27607 Available from originator only

Telephone (919) 737-2332

Three-Dimensional Simulation Package AUGUR

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Language - FORTRAN 1V/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:

(4) 1 x 1 x 1	(e) NC x l x l	where NC = maximum volumes along the west to
(b) 1 x NR x 1	(f) NC x NR x l	east axis
(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
		uddet axis

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

(a) corner coordinates(b) volume centroid	(d) projected are.s onto XY, XZ, and YZ planes of the volume's faces
(c) centroids 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	Copy on file at NODC (Flogram code on magnetic
University of Washington	tape). Documentation (above report) available
Seattle, WA 98195	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 freshwater 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 Salanced 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.

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Cheaspeake Bay Institute The Johns Hopkins University Baltimore, MD 21218 Copy on file at NODC (above report)

Modeling an Ocean Pond

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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-Fang Wang, University of Rhode Island, 1975.

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

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, ammonía, urea, dissolved oxygen, silicate, and phosphate. Author - Stephen A. Macko.

> B.J. McAlice Available from originator only Ira C. Darling Center (Marine Laboratory) University of Maine at Orono Walpole, ME 04573 Telephone (207) 563-3146

Estuarine Tides TID: 1 Language - WATFIV FORTRAN Hardware - IBM 370

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

B.J. McAliceAvailable from originator onlyIra C. Darling Center (Marine Laboratory)University of Maine at OronoWalpole, ME 04573Telephone (207) 563-3146

 Mathematical Model of Coastal Upwelling:
 Language - FORTRAN IV

 Drift, Slope, and Littoral Currents
 Hardware - IBM 360-40/23K bytes

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 OCEØ1PØ7

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 cosst, 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 Copy on file at NODC (listing, Diretoria de Hidrografia e Navegacao BCO Nacional de Dados Oceanograficos Primeiro Distrito Nave? - Ihla Fiscal Rio de Janeiro - GB-20.000, Brasil

Beach and Nearshore Maps

Language - FORTRAN IV Hardware - IEM 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.

> William T. Fox Williams College Department of Geology Williamstown, MA 01207

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 latera' y 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.

> Cheaspeake Bay Institute The Johns Hopkins University Baltimore, MD 21218

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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 parametels, 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. 1, Final Report, Vol. II, User's Manual; supplementary Letter Report.

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L.W. Hallanger Copy on file at NODC (Deck) Civil Engineering Laboratory Naval construction Battelion Center Port Hueneme, CA 93043 Telephone (805) 982-5787

Load Motion and Cable Stresses CAB1

Language - FORTRAN IV Hardware - CLC 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.

H.S. Zwibel	Copy on file at NODC (Deck)
Civil Engineering Laboratory	
Naval Construction Battalion Center	
Port Hueneme, CA 93043	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, A, minor and major principal effective stress, principal stress ratio, P, Q.

> H.J. Lee Copy on file at NODC (Deck) Civil Engineering Laboratory Neval Construction Battalion Center Port Hueneme, CA 93043 Telephone (805) 982-5624

Dynamic Stress Response of Lifting Lines, CABANA Longuage - FORTRAN IV Hardware - CDC 6500/2 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 Tichnical Report R-703, "Dynamic Stress Response of Lifting Lines for Oceanic Operations," by C.L. Iiu, Nov. 1970.

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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. (utput: Tension and mass point location as function, of time. CEL Tech. Note N-1288, "Snap Loads in Lifting and Mooring Cable Systems Induced by, urface Wave Conditions," by F.C. Liu, Sept. 1973.

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

Changes in Electromechanical Cable RAMSC

Language - FORTRAN IV 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.

Francis C. LiuCopy on file at NODC (Deck)Civil Engineering LaboratoryNaval Construction Battalion CenterPort Hueneme, CA 93043Telephone (805) 982-4613

End Responses in Electromechanical Cable RADAC

Language - FORTRAN IV 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 torsiors, cable elongation, cable geometric changes, wire tensions. Note: RAMSC and RADAC have been _ombined to form program TAWAC.

Francis C. LiuCopy on file at NODC (Deck)Civil Engineering LaboratoryNaval Construction Battalion CenterPort Liucneme, CA 93043Telephone (865) 982-4613

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-01-74-02-01.

Edward J. FinnAvailable from originator onlyOcean Instrumentation BranchNaval Research Laboratory, Code 8422Washington, DC 20375Telephone (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-01-74-01-01.

Edward J. FinnAvailable from originator onlyOcean Instrumentation branchNaval Research Laboratory, Code 8422Washington, DC 20375Telephone (202) 767-2112

Unmanned Free-Swimming Submersible Nominal UFSS Program

Language - BASIC 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 - FORTPAN 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

1

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 iteus to be modeled. Output: x-z positions, tersions 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 Loudon, CT 06320	Telephone (203) 442-0771

Cable-Towed	Bucy	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 threedimensional 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. Threedimensional 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

2

Language - FORTRAN V Hardware - UNIVAC 1108

The equations of motion for spar bucy, cable (lump mass model), and an extended three-leg structure are solved in the time domain using a fourth order Runge-Kurta 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:--71, Nov. 1971.

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

Free-Floating Spar Buoy Dynamics

6

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3

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 vaves 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.

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

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, cach having two degrees of freedom. The $2 \times \alpha$ equations of motion are solved simultaneously in the time domain using a fourth order Runge-Kutts algorithm. Velocity-squared

1

viscous forces and hydrodynamic masses are concentrated at each lump. NUSC Tech. Hemo. 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	Available from originator only
Naval Underwater Systems Center New London, CT 06320	Telephone (203) 442-0771

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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.

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

Buoy-Ship Dynamics

Language - FORTRAN V Hardware - UNIVAC 1108

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

Fixed Thin Line Array Dynamics

Language - FORTRAN V Hurdware - UNIVAC 1108

Equations of motion for the cable array are solved in the time domain for excitation by currencs. The array is broken up into n elastically connected lump misses, each having three degrees of freedom. The 3 x n equations of motion are solved simultaneously, using a fourth order Runge-Kutts algorithm. Velocity-squared viscous forces and hydrodynamic masses are concentrated at each lump. Kirk T. Patton or Gary T. Griffin Naval Underwater Systems Center New London, CT 06320 Available from originator only

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.

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Kirk T. Patton or Gary T. Griffin
Naval Underweter Systems CenterAvailable from originator onlyNew London, CT 06320Telephone (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 Naval Underwater Systems Center New London, CT 06320 Available from originator only Telephone (203) 442-0/71

Steady-State Buoy System Configurations

Language - FORTPAN V Hardware - UNIVAC 1108

Steady-state configurations under forces due to winds and currents are computed. The threedimensional 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 jackages mounted in or on the line can be accounted for also. Output: buoy drift and cable 2-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
Naval Underwater Systems CenterAvailable from originator onlyNew London, CT 06320Telephone (203) 442-0771

Steady-State Subsurface Buoy System Configurations

Language - FORTRAN V Hardware - UNIVAC 1108

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Steady-state configurations under forces due to currents are computed. The three-dimensional cable equations are integrated with a fourth order Runge-Autta 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. 1A12-50-73, "Remote Terminal Usage to Compute Subsurface Single Leg Array Configurations" by G.T. Griffin, Nov. 1973.

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New London, CT L6320	Telephone (203) 442-0771

Towed Array Dynamics

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Language - FORTRAN V Hardware - UNIVAC 1108

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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.

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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.

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New London, CT 06320	Telephone (203) 442-0771

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

Trapezoidal Array Deployment Dynamics

4

Language - FORTRAN V Hardware - UNIVAC 1108

Equations of motion for a trapezoidal erray 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	Available from originator only
Naval Underwater Systems Center	
• New London, CI 06320	Telephone (203) 442-0771

Trapezoidal Array Dynamics

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Language - FORTRAN V Hardware - UNIVAC 1108

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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.

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New London, CT 06320	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) 42-0771

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 Copy on file at NODC (listing, documentation) Wormley, Godalming, Surrey, England

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 vis-cosity (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.

JCl. De Bremmecker Rice University	Copy on file at NOEC
P.O. Box 1892 Houston, TX 77001	Telephone (713) 528-4141
Gravitational Attraction, Two Dimensional Bodies, TALWANI 2-D GRAVITY, W9206	Language - FORTRAN IV-H Hardware - IBM 360-65

Contains option of units in miles, kilofeet, or kilometers.

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.

Computer Center Division U.S. Geological Survey	Copy on file at NODC (listing, documentation)
National Center Reston, VA 22092	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, 20 angles, intensities and peak heights of diffraction maxima, list of minerals and estimated amounts in samples analyzed.

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Telephone (617) 548-8700
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Sediment Grain Size Analysis

Language - FORTRAN IV Hardware - IEM 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	Program maintained by:
U.S. Geological Survey	Computer Center Division
P.O. Box 6732	U.S. Geological Survey
Corpus Christi, TX 78411	Federal Center
Telephone (512) 888-3241	Denver, CO 80225

Magnetic Anomalies MAG2D

Geo

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Language - FORIRAN IV Hardware - XDS Sigma 7/32K 32 bit words/ Pletter

Computes theoretical magnetic anomalies for two-dimensional bodies magnetized in any specified direction. Vertical, horizontal, and total field anomalies are computed at a serie; 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	Copy (main program) on file at NODC (listing, documentation)
Office of Marine Geology Woods Hole, MA 02543	Telephone (617) 548-8700
eophysical 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 Jata 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	Available from originator only
School of Oceanography	
Oregon State University	
Corvallis, OR 97331	

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).

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

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).

Available from originator only

A Library of Geophysics Subroutines GLIB

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

> Language - 0S3 FORTRAN IV/COMPASS Hardware - CDC 3300

The library consists of various subroutires 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 subrourines. Tech. Report by K. Kzeling, M. Gemperle, and G. Connard (in press, 1975).

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Z

Reduction, Display and Storage of Navigation, Language - FORTRAN IV (most of the programs) uravity, Mignetic and Depth Data 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 along the chois track. The finally reduced data may be stored on magnetic tape in any of the Internatio ' Geophysical Data Exchange Formats. With this system it is possible to reduce data and proa ce maps and final reports within three weeks of the end of the survey. The complete system can be used at sea with one engineer neer 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. \dot{x} 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 Hain 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 Eoppler 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 Copy on file at NODC (Above manuals) Institute of Oceanographic Sciences Kestarch Vessel Base, No. 1 Pock Barry, South Glamorgan, Wales, UK

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 Seophysics," by William E. Byrd, Jr., June 1967; program modified and expanded from Telwar! 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	Available	from originator only
Woods Hole Oceanographic Institution Woods Hole, MA 02543		(617) 548-1400, ext. 469
woods hule, na 02343	rerebuone	(017) 340-1400, ext. 409

Marine Geophysical Data Reduction

Language - FORTRAN IV Hardware - IBN 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 essociated 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
 Copy on file at NODC (Above report, with

 Marine Geology and Geophysics Branch
 listing)

 National Geophysical and Solar~
 Terrestrial Data Center, NOAA/EDS

 Boulder, CO
 80302

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 Jistance 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 wertical 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 tames 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 repletted in a different manner (for example, with a different vertical exaggeration) if desired. ESSA Technical Memorandum ERLTM-AOMI 8, "Computer Program for Automatic Plotting of Bathymetric and Magnetic Anomaly Profiles," by Paul J. Grim, Atlantic Oceanographic and Meteorological Labc atories, Miami, Florida, July 1970.

Paul J. Grim, Code D621Copy on file at NODC (Above report, with
Marine Geology and Geophysics Branch
1isting)National Geophysical and Solar-
Terrestrial Data Center, NOAA/EDS
Boulder, CO 80302

Lists Raw Data ZLIST

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Language -Hardware - UNIVAC 1108

Lists a single file of MG6G standard raw data tape, according to a standard format. Requires subroutine DLIST (HRMIN). Author - R.K. Lattimore.

Available from originator only

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Director, Marine Geology and

Plots Trackline OCKDRAW Language -Hardware - UNIVAC 1108

Telephone (305) 361-3361

Using as input the standard MGGG 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 Atlautic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Available from originator only

Telephone (305) 361-3361

Plots Contour-Crossing Intervals DOUBLX

Language -Hariware - 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 consectively. Author - J.W. Lavelle.

> Director, Marine Geology and Geophysics Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Telephone (305) 361-3361

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-"itio 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. Director, Marine Geology and Availa Geophysics Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Teleph

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Lists Every Hundredth Value SNOOP

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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. Latti-ore.

Director, Marine Geology and Geophysics Atlantic Oceanographic and Meteorological Laboratories/NCAA 15 Rickenbacke: Causeway Miami, FL 33149 Telephone (305) 361-3361

Navigation Computations TPNAV

Language -Hardware - UNLVAC 1108

Accepts standard MG&G navigation lota 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 Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149

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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 Laboratorier/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Telephone (305) 361-3361

Geophysical Data Conversion "ANDY

Language -Hardware - UNIVAC 1108

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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, PLO17, ZEDIT). Requires subroutine DLIST (HRMIN). Author - R.K. Lattimore.

Director, Marine Geology and Geophysics Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Telephone (305) 361-3361

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 o: PTLLST). Author - R.K. Lattimore.

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 Atlantic Oceanographic and
 Meteorological Laboratories/NOAA

 15 Rickenbacker Causeway
 Telephone (305) 361-3361

Course, Speed, Ectvos Correction LOXXAV

Language -Hardware - UNIVAC 1108

Accepts standard MC&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 - k.K. Lattimore.

Director, Marine Geology and Geophysics Atlantic Oceanographic and Mettorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Telephone (305) 361-3361

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 UNIFOU on the CDC 6600) to the standard NG6G storage format. Author - R.K. Lattimore.

> Director, Marine Geology and Geophysics Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Minmi, FL 33149 Telephone (305) 361~3361

Sound Velocity Variation and Navization. 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 MG6G reduced-data format. Requires subroutines GP, HRMIN, QUIT (TPLIST). Author - R.K. Lattimore.

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Telephone (305) 361-3361

Regional Field, Residual Magnetic Anomaly GAMMA

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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, BMME, SETUP, QUIT (TPLIST). Author - R.K. Lattimore.

> Director, Marine Geology and Geophysics Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Telephone (305) 361-3361

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 freeair anomaly from the 1930 International formula for theoretical gravity. Requires subroutines GOFIND, GPGAL, HRMIN, QUIT (TPLIST). Author - R.K. Lattimore.

> Director, Marine Geology and Geophysics Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Gauseway Miami, FL 33149 Telephone (305) 361-3361

Plots Profiles of Geophysical Data DISPLOT

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Language ~ Hardware ~ UNIVAC 1108/offline CalComp plotter

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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 MGG 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 irom 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 LRL AOML-11, "A Computer Program for Reducing Marine Bathymetric, Magnetic, and Gravity," by Faul J. Grim, January 1971. Author - Robert K. Lattimore, October 1971.

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Director, Marine Geology and Geophysics Atlantic Oceanographic and 15 Rickenbacker Causeway Miami, FL 33149

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Meteorological Laboratories/NOAA

Telephone (305) 351-3361

Converts Digitizer Data EYCYT

Language -Hardware - UNIVAC 1108

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

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 21, 22, 23, 24 (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 21-24, 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, TPLIFT. Author - R.K. Lattimore.

Director, Marine Geology and Available from originator only Geophysics Atlantic Oceanographic and Meteorological Laboratories/NOAA 15 Rickenbacker Causeway Miami, FL 33149 Telephone (305) 361-3361

Seamount Magnesization

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	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	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 - M.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.

Track and Data Profile	Language - FORTRAN		
New London, CT 06320	Telephone (203) 442-0771, ext. 2305		
Peter D. Herstein Naval Underwater Systems Center	Available from originator only		

Plots Track and Data Profile TRACK

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.

	Janes V. Massingill	Available from originator only
	Environmental Sciences Section	
•	Naval Research Laboratory	
	Washington, DC 20375	Telephone (202) 767-2024

GEODATA

Language - FORTRAN Hardware - CDC 3600/3800

Hardware - CDC 3600/3800

Stores navigation, bathymetry, and magnetic data on magnetic tape in BCD form. Uses the format recommended by $t^{b}e$ National Academy of Sciences.

James V. Massingill	Available from originator only
Environmental Sciences Section	-
Naval Research Laboratory	
Washington, DC 20375	Telephone (202) 767-2024

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 lpboard 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-7j-3.

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

Available from originator only

Telephone (902) 426-3410

Magnetic Signatures MAGPLOT

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Language - FORTRAN Hardware - CDC 3600/CDC 3800/706,768 words/Unline 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 Naval Research Laboratory	Available from originator only		
Washington, DC 20375	Telephone (202) 767-2530		
Sediment Size	Language - FORTRAN Hardware - UNIVAC 1108/9K 36 bit words		
Produces frequency distributions for soil particular	rticle size values; applied to marine sediments.		
Joseph Kravitz U.S. Naval Oceanographic Office	Copy on file at NODC (deck with documentation)		
Weshington, DC 20373	Telephone (202) 433-2490		
Bottom Sediment Distribution Plot	Language - FORTRAN V Hardware - UNIVAC 1108/23K/Drum/3 tape units/		

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

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

CalComp 905/936 system

Sand, Silt, and Clay Fractiona DSDP/GRAIN

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Language - ALGOL 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 1 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 Direc 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 proporties, to which the output from this program is added.

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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 lo02 consolidation and the time and void ratio at 502 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 mettlement, 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 abscisse on variable scales.

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

Civil Engineering Laboratory Naval Construction Battalion Center Port Hueneme, CA 93043 Stalion Center S5.75 paper, \$2.25 microfiche.

BIOLOGY

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WHOI Biology Series Language - FORTRAN IV Hardware - XDS Sigma 7/plotter optional FTAPE 9,000 words **™LISHT** 9,054 words 32,439 words CHASPIT SELECT 58 words CHANAT 16,751 words 12,200 words PREPLOTG 18,000 vords PLOTSPECG 4,164 words STATAR

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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, follow ng 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):10.-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 dats; 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.

R.L. Haedrich Available from originator only Woods Hole Oceanographic Institution Woods Hole, MA 02543 Telephone (617) 548-1400, ext. 354

Optimal Ecosystem Policies OEP Language - FORTRAN Hardware - IBN 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	Available from originator only
Department of Fisheries and	-
Wildlife Sciences	
Virginia Polytechnic Institute	
and State University	
Blacksburg, VA 24601	Telephone (703) 951-6944

Inverse Problem in Ecosystems Analysis

Language - FORTRAN 1V 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 aubroutine 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 Analusis," by Curtis Mobley, J. Theoretical Biology, 41, 119-136 (1973). Program documentation is NRI Tech. Ref. 72-64.

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

	Language	-	FORTRAN IV Level G
ROBIT 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-squat2), 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: LC30, 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 Gulf Breeze Environmental Research Laboratory Environmental Protection Agency Sabine Island, Gulf Breeze, FL 32561

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Telephone (904) 932-5326

Species Affinities REGROUP

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Language - FORTRAN Hardwars - 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, c:c. 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.

> Scripps Institution of Oceanography Copy on file at NODC (listing, documentation) P.O. Box 1529 La Jolla, CA 92037

Productivity OXYGEN

Language - FORTRAN IV Hardware - CDC 6600

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

> Marine Science Institute The University of Texas Port Aranses, TX 78373

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Species Diversity JOB

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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 $g_{\rm outp}$. Other desired groupings may be entered by a groupings control card. Author - A.D. Eaton.

> Marine Science Institute The University of Texas Port Aransas, TX 78373

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Productivity ECOPROD !anguage - FORTRAN IV Hardware - CDC +600/25 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.

> Marine Science Institute The University of Texas Port Aransas, TX 78373

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Concentrations per Square Meter of Surface

Language - FORTRAN IV Hardware - IBM 7074-11/7040 DCS/2231 words

Computes various chemical and biological compound concentrations as well as productivity rates per aquare 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 UMMS-1006, June 1966. Source deck has 771 cards. Authors - Leilonie D. Gillespie and Linda S. Green.

> Department of Occanography University of Washington Seattle, WA 98105

Copy on file at NODC (above report)

Combined Chlorophyll and Productivity

Language - FORTRAN IV Hardware - CDC 6400

Computes assimilation of productivity in iewater; also computes the quantities of chlorophyll A, B, and C, and the amount of carotenoid: 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 ierive 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 N.R. Rona; revised in 1969 for the CDC 6400.

> Department of Oceanography University of Washington Seattle, WA 98105

Copy on file at NODC (listing, documentation)

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 quantitics are obtained from microscopic examination of seawater samples. A subroutime computes the area, volume, and plasma volume of a cell from measured dimensions of diverse species. Source deck has 1/21 cards. Special Report No. 38, M66-41, July 1966, by Paavo E. Kovala and Jerry D. Larrance.

> Department of Oceanography University of Washington Seattle, WA 98105

Copy on file at NODC (above report)

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	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	Telephone (203) 442-0771, ext. 2127

Deep-Ocean Looplankton Distribution

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

The purpose of the program is to study the distribution statistics of the deep-ocean zooolankton 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.

Drew DrinkardAvailable from originator onlyNaval Underwater Systems CenterTelephone (203) 442-0771, ext. 2127

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. Drew Drinkard Naval Underwater Systems Center New London, CT 06320 Available from originator only

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NAMES IN CONTRACTOR OF A DESCRIPTION

PIGMENT RATIO

2

Language - FORTRAN IV Hardware - IBM 360/less than 500/0 bytes

Computes ratios: Chl \underline{a} /Carot, Pheo/Carot, (Chl \underline{a} + Pheo)/Carot, Chl \underline{b} /Carot, Chl \underline{c} /Carot, and Fluor/(Chl \underline{a} + Pheo). Input: Sample identification, chlorophylls \underline{a} , \underline{b} , \underline{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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Paul J. Godfrey Department of Natural Resources Cornell University, Fernow Hall Ithaca, NY 14850 Copy on file st NODC (listing, documentation)

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. Coldman, 1974, Amer. Naturalist 108:668-693. 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.

Paul J. Godfrey	Copy on file at NODC (listing, documentation)
Department of Natural Resources Cornell University, Fernow Hall	
1thaca, NY 14850	Telephone (607) 256-3120

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.

Paul J. Godfrey	Copy on file at NODC (listing, documentation)
Department of Natural Resources	
Cornell University, Fernow Hall	
Ithaca, NY 14850	Telephone (607) 256-3120

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.

1915 (1944) - 1944) -

Fisheries Research Board of Canada Copy on file at NODC (above report) Biologica. Station Nanaimo, B.C.

Chlorophyll CHLOR

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Language - FORTRAN Hardware - IBM 370

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

8.J. McAliceAvailable from originator onlyIra C. Darling Center (Marine Laboratory)University of Maine at OronoWalpole, ME 04573Telephone (207) 563-3146

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.

B.J. McAliceAvailable from originator onlyIra C. Darling Center (Marine Laboratory)University of Maine at OronoWalpole, ME 04573Telephone (207) 563-3146

Species Diversity DVRSTY Language - WATFIV FORTRAN Hardware - IBM 370

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

B.J. McAlice Available from originator only Ira C. Darling Center (Marine Laboratory) University of Maine at Orono Walpole, ME 04573 Telephone (207) 563-3146

FISHERIES

2

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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Atilio L. Coan, Jr.Available from originator onlySouthwest Fisheries CenterNational Marine Fisheries Service, NOAAP.O. Box 271La Jolla, CA 92037Telephone (714) 453-2820, ext. 285

Yield per Recruit for Multi-Gear Fisheries MGEAR

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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 fighting mortality.

William H. Lenarz Available from originator only Southwest Fisheries Center National Marine Fisheries Service, NOAA P.O. Box 271 La Jolla, CA 92037 Telephone (714) 453-2820, ert. 280

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.

Robert T. LackeyAvailable from originator onlyDepartment of Fisheries and
Wildlife SciencesAvailable from originator onlyVirginia Polytechnic Institute
and State UniversityFisheriesBlacksburg, VA 24061Telephone (703) 951-6944

Computer-Implemented Water Resources Teaching Game, DAM Language - FORTRAN IV Hardware - IB:1 370/120K/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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Robert T. Lackey Department of Fisheries and Wildlife Sciences Virginia Polytechnic Institute and State University Blacksburg, VA 24061

Telephone (703) 951-6944

A Generalized E::ploited 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 total fishable population, (4) the total population, average population, average fishable population, yield in number and weight, and the spawing 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. "A general life history exploited pulation, subjusted population singulator with pandalid shrimp as an example," by William U. Fox, Jr., Fishery Bulletin, U.S., 71 (4): 1019-1028, 1973.

William W. Fox, Jr.Available from originator onlySouthwest Fisheries CenterNational Marine Fisheries Service, NOAAP.O. Box 271La Jolla, CA 92037Telephone (714) 453-2820, ext. 345

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. Our, ut includes a listing of the input data, the transformed data, initial parameter estimates, the iterative solution steps, the management implications of the final model $*^{Umax}$, Uopt, iopt, and Ymax and their variability indices, the observed and predicted values and error terms, estimates of the catchability coefficient, and a table of equilibrium values. ($*^{Umax}$ is the relative density of the population before exploitation; Uopt is the relative population density providing the maximum sustainable yield; is the amount of fishing effort to obtain the maximum sustainable yield; and Ymax 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.

William W. Fox, Jr.	Available	from originator only	
Southwest Fisheries Center			
National Marine Fisheries Service,	NOAA		
P.O. Box 271			
La Jolla, Ci 92037	Telephone	(714) 453-2820, ext. 345	

Normal Distribution Separator TCPA1

Language - FORTRAN 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 TCPA2

Language - FORTRAN Hardware - Burroughs 6700

Estimates the parameters of the Elcker spawner-recruit curve, $R = ASe^{-bS}$, from fitting the logarithmic transformation Ln(R/E) = LnA-ba, by the method of least squares. S is the spawning bio-mars, 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 "Kandbook 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.

> Christopher T. Psaropulos
> Available from originator only Inter-American Tropical Tuna Commission
>
>
> Southwest Fisheries Center
> Post Office Box 271
>
>
> La Jolla, CA 920:7
> Telephone (714) 453-2820, ext. 310 or 253

Weight-Length Curve Fitting TCPA3

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Language - FORTRAN 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 TCPB1

Language - FORTRAN 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 (<u>Thunnus germo</u>) catch for relative age composition," by D.J. Mackett, Proc.World.Sci. Meet.Biol.Tunas & Rel.Sp., FAC Fish.Rpt. No. 6, Vol. 3, 1963. Author - D.J. Mackett.

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Best Current Estimate of Numbers, Percentages, Language - FORTRAN and Weights of Fish Caught, TCPB2 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 light-frequency interval. Listtations: (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

1.1

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 arca 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.

 Christopher T. Fsaropulos
 Available from originator only

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 Southwest Fisheries Center

 Post Office Box 271

 La Jolla, CA 92037

 Telephone (714) 453-2820, ext. 310 or 253

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 $D_{t} = \text{length}$ (at age t) = $A+BR^{t}$; O<R<F1 (1) by least squares when data of the form (length, age) are given in pairs (L_{t} , t). The programminimizes the function $Q = \frac{n}{2}(L_{t} - A - BR^{t})^{2}$ by use of the functial derivatives evaluated near zero.

Output is in the von Bertalanffy form, where $A = i_{\infty}$, $R = e^{-k}$ or $K = -\log_e R$, $B = -i_{\infty} l^{ktO}$ or $t_0 = (\log_e(-B)-\log_e A)/K$.

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 Lutervals 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 $L_t = L_m$ $(1 - e^{-K(t-t_0)})$ wher, $L_t =$ length at time t, $L_m =$ asymptotic length, K = growth constant, and t_0 = 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_m , K, and t_0 from each iteration of the fitting process; (2) final estimates of L_m , K, and t_0 ; (3) standard errors of L_m , K, and t_0 ; (4) fitted ler ths for age 0 through the maximum included in the input; (5) mean lengths in 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-covcriance 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 ICPC 3)

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Von Bertalanffy Growth Curve for Equal Age Intervals TCPC3 Language - FORTRAN Hardware - Burrou hs 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_{ω} 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).

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

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

 $Q = {n \choose t} [L_t + \Delta_t - L_t R^{\Delta t} - A (1 - R^{\Delta t})]^2$ 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. Tomlinion.

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Estimation of Linear Growth and von Language - FORTRAN Bertalanffy Growth Equation from Tag Data Hardware - Burroughs 6700 TCPC5

This program is used to estimate the rate of linear growth per unit time and the parameters L_m 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_m 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

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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. "Lognormal 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

2

Language - FORTRAN Hardware - Burroughs 6700

Estimates a survival rate from the age composition of a sample. Computes a number of statistic: measures associated with a vector of cat; 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 entired in catch vector; (b) all ages in catch vector are fully available to sampling guar; (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 injerval.

Option 2 tests the hypothesis that the relative frequency in the O-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: $N_1 = N_0$; $N_2 = N_1$; $N_3 = N_1$; $N_3 = N_2$; \dots ; $N_1 = N_1$ and the above computations are made for the new vector N_0, \dots, 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 subject is then 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 irequencies are not reliable for fish of ages K+1, K+2,...,I in the vector of catch numbers; it sums the match 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 $m = N_{K+1} + \cdots + N_1$.

Option 4 peraits 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 spear in more than one segment. Option 4 computes the same output es 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 TCPE2

Language - FORTRAN Herdware - Burrougts 6700

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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 coefficcients 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 H 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 TCPF1

1964. Author - Lawrence E. Gales.

Language - FORTRAN 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 $E = (F/(F^{+}!))$ 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 1000 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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 Southwest Fisheries Center

 Post Office Box 271

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 Yield Cu^{-...} with Constant Rates
 Language - FORTRAN

 RCPF2
 Hardware - Burroughs 6700

 Using the incomplete beta-function, evaluar
 Beverton and Holt yield equation and produces

 an array of coordinates for plotting yield
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Eunetric Yield TCPF3 Language - FORTRAN Hardware - Burroughs 6700

Uses Beverton and Holt's (1957: 36:4.4) equation to compute the population in numbers, the usomass, 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 Cuives TCPF4

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Language - FORTRAN Hardware - Burroughs 6700

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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 Alcker's wethod icr 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 G.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 Language - FORTRAN Age is Unknown Hardware - Burroughs 6700 TCPF5

Perform: 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 nortality. 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 Scheefer's Model TCPF6 Language - FORTRAN Hardware - Burroughs 6700

Uses three simultaneous equations to solve for the constants, a, M, and k₂, 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 Comma. 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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Schwefer Logistics Model of Fish Production TCPF7

Language - FORTRAN 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 \leq as intervals; the program will make the guesses and set the values used in the search. "A $g_{\rm e} \leq 11226$ 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 mai.agement 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 TCPF9 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., Bill. 13(3):419-496. Authors - Pella and Tomlinson; modified by Catherine L. Berude.

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Biometry - Linear Regression Analysis La TCSA1 Ha

Language - FORTRAN 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 $by = a+\beta X$; (c) that for any given value of X the Y's are independently and normally distributed. $Y = (+\beta X)t$, where c is assumed to be normally distributed error term with a mean of zero; (d) that the magnitude of X or Y. In Nodel 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. Nodified 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 $Y_1 \approx b_n + b_{1}x_1$ where the Y_1 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 as used -- 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: "atural 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 I. Pasropulos.

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Biometry - Product-Moment Correlation Coefficient, TCSB1 Language - FORTRAN Hardware - Burrougna 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. <u>Biometry</u>, by Robert R. and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969.

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Cooley-Lonnes Multiple-Regression Analysis TCSB2

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Language - FORTRAN 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. <u>Multivariate Procedures for Behavorial Sciences</u>, 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. <u>Biometry</u>, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Nodified by Walter Kitter 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)2 confidence intervals where applicable. <u>Biometry</u>, 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 La Anova, TCSD1 Ha

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. <u>Biometry</u>, 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, Sau Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Sum of Squares STP TCSD3

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Language - FORTRAN 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). <u>Bicmetry</u>, 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 TCSD4 Language - FORTRAN Hardware - Burrought 6700

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

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Biometry - Test of Homogeneity of Variances TSCE1

Language - FORTRAN Hardware - Burroughs 6700

Performs Bartlett's test of homogeneity of variances and the F test. <u>Biometry</u>, 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 beterogenous. 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 $F_{\rm g}^{\rm c}$ 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 0. Christopher T. PsaropulosAvailable from originator onlyInter-American Tropical Tuna CommissionSouthwest Fisheries CenterPost Office Box 271La Jolla, CA 92037Telephone (714) 453-2820, ert. 310 or 253

Biometry - Tukey's Test for Nonadditivity
TCSE3

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Language - FORTRAN 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. <u>Biometry</u>, 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 TSCE4 Language - FORTRAN 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. <u>Biometry</u>, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter U.

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Biometry - Fisher's Exact Test TCSE5

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Language - FORTRAN 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. <u>Biometry</u>, 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

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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 Wohert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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POLLUTION

Monte Cirlo Spill Tracker

Language - PL/1 Optimizer Hardware - 184 370-168/216 K bytes (characters)

Provides insight on likely of spill trajectories in a given region by season, using Monte Carlo sumpling of Markov wind model at one- or three-hourly intervals; spill novement assumed to be linear combination of momentary wind and current vectors. In, ut: Mip of area, cutput files from analysis of 10F-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 MINSG 74-20, "Primary, Physical Impacts of Offenore 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 hit words

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

Kevin M. Rabe Environmental Prediction Research Facility Naval Postgraduate School Monterey, CA 93940 Available from originator only

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Substance Adv ction/Diffusion Routing

Language - FORTRAS Herdware - 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. EPKF Tech. Note 1-74, "A Vertically Integrated Hydrodynamical-Numerical Model."

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Danish Advection Program

Language - FORTRAN Hardware - CDC 31007/CDC 656+

Computes advection of pollutants (or mass) in a fluid in two dimensions. Input: Velocities in X and Y, cases and grid spacing in ρ the Y, sil for each grid point; timestep and total time or advection. Durput: initial gridpoint of field advected and final field after total solvection. Quasi-Lawrangian method used, utilizing mass, center of mass, and width of mass dimeribution, all for each grid point. Storage requirement is grid-mize dependent: for XX by XY grid, (XXANYA7) + (XX41)428 words. "A Method for Numerical Solution of the Advection Lquation," by L.3. Pederson and L.P. Fram, Meteorological Institute, Denmark, Aug. 1973, 36 pp.

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Ecological Statistical Computer Programs ECOSTAT Language - ANS FORTRAN* Hardware - 18M 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; (?) 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) dissimilative coefficients by taxon between regions, between samples for each station, between surveys by region, (c) ANOVA cables among surveys by region; (3) Multivariate statistics: (a) linear correlation coefficients by region between parameters; (4) Abiotic-biotic relationships: (a) means, standard ceviations, ranges of physical parameter 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, ESD 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.

Lata ProcessingAvailable from originator onlyTechnical Services DepartmentLos Angeles County Sanitation Districts1955 Workman Mill RoadWhittler, CA 90601Telephone (213) 699-7511

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CURRENTS AND TRANSFER PROCESSES

Drift Bottle Statistics

Language - PL/1 Optimizer Hardware - IBM 360-168/2001

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 See Grant Project Office, April 1:174.

 Robert J. Stewart
 Available from originator only

 Massachusetts Institute of Technology
 Room 5-207

 Cambridge, MA 02139
 Telephone (617) 253-5941

Drift Bottle Plots

Lan Mage - PL/1 Haroware - 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 Perroleum Developments," by Stewart and Devanney, MIT See Grant Project Office, April 1974.

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Reformat and Sort Drift Bottle Data CNDNSDTA

Language - PL/1 Hardware - IBM 370-168/250K/D1sk

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

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Language -Hardware -

calculates current profiles generated from tilt d.ta 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.

Gary T. Griffin Naval Underwater Systems Center New London, CT 06320 Available from originator only

Telephone (203) 442-0771

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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.). Cutput: Listing of converted data and statistics and a new disk file of converted data. Using this data file and a plot data card, CUERPLOT 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.

K. Crocker	Available from criginator only
Naval Underwater Systems Center	
Newport, RI 02840	Telephone (401) 841-3307

Current data SPECTRUM Language - FORTRAN Hardware - CDC 3300

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

> K. Crocker Naval Underwater Systems Center Newport, RI 02840

Available from originator only

Telephone (401) 841-3307

Optimized Multi-layer HN Model

Language - C.X. FORTRAN EXTENDED Hardware - C.C. 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-usale 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.

> T. Laevastu or A. Stroud Environmental Prediction Research Facility Naval Postgraduate School Monterey, CA 93960

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Available trom originator only

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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Taivo Laevastu Environmental Prediction Research Facility Naval Postgraduate School Monterey, CA 93940 Available from originator only

Telephone (408) 646-2937

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. htput: Nature points (latitude, longitude) for each datum time. UPNAV 1:ST 3130.5A, 7 Dec. 1972, FNWC Tech-Note 60, August 1970.

LCDR John Gossner	Available from originator only
Fleet Numerical Weather Central	•
Monterey, CA 93940	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 - Kobert R. Gleason.

Data Systems Office	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	Telephone (301) 763-1449

In-Situ Current

Lanyuage - 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	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	Telephone (202) 433-3278

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 for selected wilt time in nautical miles; tabular printout, tape, or both.

Gerald Williams	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	Telephone (202) 433-4187

Current Meter Print

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

Calculates occan current speeds and directions from Geodyne AlOl 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	Available from originator only
U.S. Naval Oceanographic Office Washington, DC 20373	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.

Geralc Williams	Available from originator only
U.S. Maval Oceanographic Office	
Washington, DC 20373	Telephone (202) 433-4187

Convert Current Meter Tape	Language - FORTRAN V
HAGPACK	Hardware - UNIVAC 1108/EXEC 8/Instructions 647
	words/Data 707 words/2 tape units

Converts binary dats 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 FORTKAN field functions and output blocked and formatted with subroutine NAVIO. Author - Peter J. Topoly.

Data Systems Office	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	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 AlOl 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	Available from originator only
U.S. Naval Oceanobraphic Office	
Washington, DC 20373	Telephone (301) 763-1449

Current Meter Clack Sequence

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Language - FORTRAN IV Extended Haroware - XDS Signa 7/48K words (192K bytes)

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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
 Available from originator only

 Woods Hole Oceanographic Institution
 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.

> John A. Maitsis Available from originator only Woods Hole Oceanographic Institution Woods Hole, MA 02543 Telephone (617) 548-1400

Current Meter Data Reduction and Editing CARP

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

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

 Mary Hunt
 Available from originator only

 Woods Hole Oceanographic Institution
 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 BranchCopy on file at NODCNational Oceanographic Data CenterNOAA/EDSWashington, DC 20235Telephone (202) 634-7439

Vector Time Series CURPLT6 Lunguage - 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

Available from originator only

Telephone (206) 442-0199

Processes Current Instrument Observations

Language - FORTRAN II Hardware - IBN 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. Technical Report No. 37 (Irminger Sea Project), "Some FORTRAN II Programs for Computer Proc. 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

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Language - MS FORTRAN Hardware - CDC 3150/20K words/2 tape units/ CalComp Plotter

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

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

Telephone (902) 426-2390

TIDES

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Astronomical Tile Prediction	Language - FORTRAN IV Hardware - IBM 360-195/80K bytes
Computes hourly values and time and heights of method. Input: Tidal constituent constants.	
N.A. Pore Techniques Development Laboratory National Weather Service, NOAA 8060 Thirteenth Street	Available from originator only
Silver Spring, MD 20910	Telephone (301) 427-7614

Tides in the Open Sea

Language - FORTRAN 60 Hardware -

Predicts tides in the them sea, utilizing the basic hydrodynamic equations, for the principal lumar 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	Available from NTIS, Order No. AD 489 096/LK,
Monterey, CA 93940	\$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 eithe: a major-minor axis analysis or a north-east component approach. No data series may exceed 7,000 terus 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 taps 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. NCAA 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	Deck available from originator only; for above
Chief, Oceanographic Surveys Branch	report (including program listing), contact
National Ocean Survey, NOAA	Superintendent of Documents, U.S. Government
6001 Executive Boulevard	Printing Office, Washington, DC 20402. Price:
Rockville, MD 20852	\$.70, stock number 0317-0022.
• -	Telephone (301) 443-8501

Theoretical Radial Tidal Force

Language - MAD Hardware - 18M 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 accomedates maximum of 725 hours 30 days) of data in core storage. Author - Henry L. Pollak.

Copy on file at NODC (documented listing)

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

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WAVES

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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, ND 20970 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.

Celso S. BarrientosAvailable from NTIS: See SPLASH ITechniques Development Laboratory
National Weather Service, NDAA
8060 Thirteenth Street
Silver Spring, MD 20910Telephone (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 screeping 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 NNS TDL-50.

N.A. PoreAvailable : rom originator onlyTechniques Development Laboratory
National Weather ServiceAvailable : rom originator only8060 Thirteenth Street
Silver Spring, MD 20910Telephone (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 10(0°mb PE model wind forecasts; Output: Wind wave and swell grid printed charts to +40 hours. Technical Memoranda WBTA TEL-13 and TDL-17.

N.A. Pore Techniques Development Laboratory National Weather Service, NOAA 8060 Thirteenth Street Silver Spring, ND 20910 Available from originator only

Telephone (301) 427-7614

Wave Bottom Velocity

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Language - FOPTEAN IV G Level 21 Hardware - IBN 350-75/96K

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 Copy on file at NODC (listing, documentation) Geology Department University of Illinois Urbana, IL 61801 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.

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

Surf Prediction Model

Language - FORLRAN 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 Lution of the general wave refraction. Technical Report No. 16, by B.S.L. Smith and F.E. Cam ...d, College of Marine Studies, University of Delaware.

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

Singular Wave Prediction Model

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

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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. (utput: 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.

Sigurd Larson Environmental Prediction Research Facility Naval Postgraduate School Monterey, CA 93940 Available from originator only

Telephone (408) 646-2868

Wave Inters_tion with Current CAPGRAY

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Language - FORTRAN IV 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. LongAvailable from originator onlyCenter for Marine and Coastal StudiesNorth Carolina State UniversityRaleigh, NC 27607Telephone (919) 737-2212

Shipborne Wave Recorder Analysis SBWRO Language - FORTRAN 1V 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 predicred 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 IM-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
 (2) For program information:

 Commander and Director
 (2) For program information:

 Coastal Eugineering Research Center
 D. Lee Harrit

 Kingman Building
 Chiet, Oceanography Branch

 Fort Belvoir, VA 22060
 Coastal Engineering Research Center

Wave Refriction

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

Celculates 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 Unve kays," 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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Available from originator only

(2) For program information

 D. Lee Harris
 Chief, Oceanography Branch
 Coastal Engineering Research Center

Water-Wave Teaching Aids

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Language - FORTRAN Hardware - IBM 360-49

In teaching the engineering applications of vater-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 prograte 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' thirdorder 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 cta 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 $z \log theory$. Returns 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 part'al Perivative 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 pur; se using Stokes' second- and third-order equations.

The following four programs, dealing with spectra, were adapted (wich permission) from the Share program Gl BE TISR, written at Bell Laboratories by M.J.R. Healy, 1962: DrTRND 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, I, of the time series X(I), I = 1, N; AUTCOV computes the autocovariance, Y(K), K = 0, I, 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, H + 1, of the series X(K), K = 1, H + 1 (smoothing of either is optional, with coefficients .25, .40, .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.

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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 surfice. A table of F and M_0 vs. t is printed out.

EDIST 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 vide," by R.H. Cross, Sept. 1983.

Department of Civil Engineering Copy on file at NODC (above report) Massachusetts Institute of Technology 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 speel 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 Devenney, MIT Sea Grant Project Office, April 1974.

> J.W. Devanney III Available from originator only Massachusetts Institute of Technology Room 5-207 Cambridge, MA 02139 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 fivedegree quadrangles, of sea and air temperatures, heat budget information, and barometric pressure; also punched cards for selected summary items.

> A.J. Good Available from originator only Southwest Fisheries Center National Marine Fisheries Service, NOAA P.O. Box 271 La Jolla, CA 92037 Telephone (714) 453-2820, ext. 325

Pyranometer and Radiometer Time Series RAD

Language - FORTRAN Hardware - CDC 6400/53K words

3 tape units

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 radiaticn, evaporative and conductive fluxes, total flux, effective back radiation, transmittance, solar altitude, and albedo.

R.K. Reed Pacific Marine Environmental Laboratory, NOAA 3711 Fifteenth Avenue N.E. Seattle, WA 98105	Available from originator only	
	Telephone (206) 442-0199	
Ocean Climatology Analysis Model ' ANALYS	Language - FORTRAN Hardware - CDC 1604/16K 48 bit words/Drum/	

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.

Kevin M. Rabe Environmental Prediction Research Facility Naval Postgraduate School Nonterey, CA 93940 Available from originator only

Telephone (408) 646-2842

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.

Kevin M. Rabe Environmental Prediction Research Facility Naval Postgraduate School Nonterey, CA 93940 Available from originator only

Telephone (408) 646-2842

Mixed Layer Depth Analysis Model MEDMLD

Language - FORTRAN/COMPASS Hardwarn - 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.

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

Available from originator only

Telephone (408) 646-2868

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 Environmental Prediction Research Facility Naval Postgraduate School Monterey, CA 93940

Available from originator only

Telephone (408) 646-2937

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.

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

Wind Computation from Ship Observations TRUWIND

Language - FORTRAN Hardware - CDC 1604/16K 48 bit words

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Calculates the crue 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.

Telvo Leovastu	Available from originator only
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Naval Postgraduate School	
Monterey, CA 93940	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).

	Jamen W. Fitzgerald	Available from originator only
Naval Research Laboratory Washington, DC 20375	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 NV 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.

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Washington, DC 20373	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 OfficeAvailable from originator onlyU.S. Naval Oceanographic OfficeWashington, DC 20373Washington, DC 20373Telephone (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.

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U.S. Naval Oceanographic Office	
Washington, DC 20373	Telephone (301) 763-1449

Prediction of Vertical Temperature Change

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Language - FORTRAN Hardware - IBM 7074/Beason-Lehner Plouter

A technique based primarily on heat budget and wind mixing calculations has been developed for predicting the vertical thermal structure of the occan; 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 12002 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 1MR No. 0-42-65, Oct. 1965. (See also DMR 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 Occur graphic Office Washington, DC 20273 Available from originator only Telephone (301) 763-1449 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 temp-rature 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

Tak-s 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 Knodie. 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

Aveilable 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 Available from originator only International Ice Patrol **U.S.** Coast Guard Bldg. 110, Coast Guard Support Center Governors Island, NY 10004 Telephone (212) 264-4798

Ice Drift Analysis/Forecast

Language - FORTRAN II Hardware - CDC 160A/8K 12 bit words/3 tape unita

Forecast or analyzed geostrophic winds and average sea-surface currents on magnetic tape are required input. The geost ophic 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 (pointr) to a maximum of 207.

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Lt. Roland A. Garcia, USN Fleet Weather Facility Suitland Suitlaud, MD 20373

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Copy on file at NODC (listing, documentation) Telephone (301) 763-5972

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SOUND

Normal Mode Calculations NORMOD3

Language ~ FORTRAN IV Hardware ~ CDC 6500/60K octal words/CalComp or other plotter

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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 presaure at the surface. NOL Tech. Report 74-95.

Ira M. Blatstein	Available from originator only
Naval Surface Weapons Center	· · · ·
White Oak	
Silver Spring, MD 20910	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

Telephone (202) 394-2334

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Sound Scattering by Urganisms SKAT Language - FORTRAN IV Hardware - CDC 1604/16K 48 bit words

Simulates the scattering of sound by organisms of various shapes and dimensions.

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

Normal Mode Propagation Model

Language - FORTHAN 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 releiver depths, bottom topography and composition, and selection of modes. For certain plots, pl cting programs are required. NUSC Report 4887-II.

> William G. Kanabis A Naval Underwater Systems Center New London, CT 06320 T

Available from originator only Telephone (203) 442-0771, ext. 2353 Sound Refraction Corrections FITIT

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Language - FORTRAN Hardware - CDC 3300

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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.

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A.E. Vaas Naval Underwater Systems Center Newport, KL 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. N.SC Technical Report 4687.

Ding Lee or Gustave A. Leibiger Naval Underwater Systems Center	Available from originator only	
New London, CT 06320	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	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	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 inputoutput requirement: Sound speed profile fitting program. NUSC Report Nos. 1046 and 4103.

Frederick R. DiNapoli	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	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. A REAL PROPERTY AND A REAL PROPERTY A REAL PROPERTY A REAL PROPERTY AND A REAL PROPERT

R. Whittaker Naval Underwater Systems Center New London, CT 06320

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Telephone (203) 442-0771, ext. 2316

Pattern Function Calculations

Language - FORTRAN IV Hardware - UNIVAC 1108

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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. Pasalena, CA 91107

Rayleigh-Morse Bottom Reflection Coefficients 'anguage - FORTRAN V Hardware - UNIVAC 1108 RAYMOR

Computes Rayleigh-Morse bottom reflection coefficients, also phase changes of the reflected and transmittel acoustic wave. Author - J.C. Reeves.

> Naval Undersea Center Pasadena Laboratory 3202 E. Foothill Blvd. Pasadena, CA 91107

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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 U.S. Naval Oceanographic Office Washington, DC 20373

Available from originator only Telephone (301) 763-1449

Propagation Loss S1587

Language - FORTRAN V Hardware - UNIVAC 1108/CalComp or Stromberg-Carlson 4060 pletter

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 S1797

Language - FORTRAN V 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. GarrettAvailable from originator onlyNaval Underwater Systems CenterTelephone (203) 442-0771, ext. 2992

SOUND VELOCITY

Sound Speed Computation Model SOVEL

Language - FORTRAN 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	Available from originator only
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Research Facility	
Naval Postgraduate School	
Monterey, CA 93940	Telephone (403) 646-2937

Sound Velocity SONVEL Language - FORTRAN IV-H 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
 Available from originator only

 Woods Hole Oceanographic Institution
 Telephone (617) 548-1400

Sound Velocity: Wilson's Formula WLSND, SVELFS, VELPRS

Language - FORTRAN Hardware - IBK 360-Co/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 occan is not necessary here. Author - Robert Van Wie.

> Occeanographic Seivices Branch National Oceanographic Data Center NOAA/EDS Washington, DC 20235 Telephone (202) 634-7439

Depth Correctio: MTCOR Language - FORTRAN IV Hardware - XDS Sigma 7/1419 32 bit words

Calculates depth correction fc. sound velocity using Matthews' tables. Established coefficients are used to approximate Matthews' tables. The Matthews' table number 1-52 must be specified.

Robert C. GromanAvailable from originator onlyWoods Hele Oceanographic InstitutionWoods Hole, MA 02543Telephone (617) 548-1400

Sound Velocity

Language - FORTRAN Hardware - UNIVAC 1108/6,100 36 bit words

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Adjusts sound velocity values for marine sediments, as recovered from laboratory velocine: er,

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

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Sonic Velocities through Solid Samples DSDP/SONHAM

Language - ALGOL. Hardware - Burroughs 6700/7K words

Computes sonic velocities through solid samples from techniciens' 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 ward 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 Jollu, CA 92037

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 only

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SOUND --- RAY PATH

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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 flotter

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Draws ray diagrams, computes eigenrays, and calculates propagation loss and reverberation. Uses Tly 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 Peport No. 4071, "Continuous Gradient Ray Tracing System (CONGRATS) III: Boundary and Volume Reverberation," by J.S. Cohen and H. Weinberg, April 1971; and other reports.

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Henry Weinberg or Jeffrey S. Cohen	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	Telephone (203) 442-0771, ext. 2589 or 2989

Acoustic Performance and Evaluation -	Language - FORTRAN
Digigraphics, APE-DIGI	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 isoloss 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 SO434B 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	Available from originator only
Naval Underwater Systems Center	•
New London, CT 06320	Telepilone (203) 442-0771, ext. 2305

Critical Acoustic Ratio

Language - FORTRAN Hardware - IBM 7074

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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

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Telephone (301) 763-1449

GRASS Underwater Acoustics Prediction System Language - FORTRAN 63 Hardware - CDC 3800/Drum Scope 2.1 CalComp Plotter

DTSTOV	DTSTOV	7,679 48 bit words
CTOUR	VFC	20,832 48 bit words
VEC	CTOUR	27,452 48 bit words
PRFPLT	PRFPLT	11,622 48 bit words
SERPENT	SERPENT	36,784 48 bit words
RAPLOT	RAPLOT	12,118 48 bit words
LOSSPLOT	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 print: 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. Twodimensional 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 rangedepth 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 r-ceivers 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.

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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 parsacters 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 requisted, plots will display random, coherent, and statistical losses together with input experimental data or theoretical curves.

"GRASS: A Digital Computer Ray Tracing and Transmission Less 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

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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 Scarch. 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 Pasadena Laboratory 3202 E. Foothill Blvd. Pasadena, CA 91107

Naval Undersea Center Pasadena Laboratory 3202 E. Foothill Blvd. Pasadena, CA 91107 Aviilable from NTIS, Order . AD 863 777 and AD 863 778, \$6.00 each volume in paper, \$2.25 each volume in microfiche.

Sorts Sound Ray Data RAY SORT Language - FORTRAN IV 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?

Available from NTIS: See "Sonar in Refractive Water."

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 Arthur D. Little, Inc. 35 Acorn Park Cambridge, MA 02140 Available from NTIS, Order No. AD 605 328, \$4.75 paper, \$2.25 microfiche.

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. Rosenbuum, June 1968. "Reference Manual," by M. Klerer and J. May, Hudson Laboratories, Revised July 1965; manual reprinted in above report.

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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 batween 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 met 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 Institu- Copy on file at NODC (listing, documentation) tion Woods Hole, MA 62543

NAVIGATION AND CHARTING

Plots Maps, Grids, Tracks MAP

Language - FORTRAN IV Hardw.re - IBN 360-65/CalComp, Houston Omnigraphic, or Gerber plotter/2 tape units

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

Astronomic Position, Azimuth Method

Language - FORTRAN IV (H cr G) Hardware - IEM 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 aujustment is iterated five times or until the corrections become leas thar 0.005 seconds, either of which causes a program h=lt. 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	Copy on file at NODC (deck, documentation)	
		Telephone (703) 860-7106	
11400	Bigs and Cab Times		

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 Biologi.al Station
 Copy on file at NODC (listing, documentation)

 Fisheries Research Board of Canada
 P. O. Box 100

 Nanaimo, B. C. V9R 5K6
 V9R 5K6

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-linc 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 Copy on file at NODC (listing, documentation) Wormley, Godalming, Surrey, England

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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 - N. Fasham.

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

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 type file for later use by program HNAV. NIO Program No. 164. Author - M. Fasham.

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

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 Nc. 46. Author - M. Fasham.

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

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

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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

5. A.

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Plots Mercator Grid CHART

Active and the party states in party independent of

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 MooreAvailable from originator onlyScripps Institution of OceanographyP.O. Box 1529La Jolla, CA 92037Telephone (714) 452-4194

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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 MooreAvailable from originator onlyScripps Institution of OceanographyP.O. Box 1529La Jolla, CA 92037Telephone (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 that in a format compatible with plotting program TMERC.

Chris PolloniAvailable from originator onlyWoods Hole Oceanographic InstitutionWoods Hole, MA 02543Telephone (617) 548-1400

Cruise Track TMERC Language - FORTRAN I" 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 PolloniAvailable from originator onlyWoods Hole Oceanographic InstitutionTelephone (617) 548-1400

 Transformation of Spherical Coordinates
 Language -, FORTRAN IV

 ROTGUT
 Hardware - XDS Sigma 7/5,500 words

Performs various operations using transformation of spherical coordinates. Output: Rotation

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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 smallcircle fit.

Christine Wooding	Available from originator only
Woods Hole Oceanographic Institution	on
Woods Hole, MA 02543	Telephone (617) 548-1400

Sum of Finite Rotations on a Sphere SUMROT

Language - FORTRAN IV Hardware - XDS Sigma 7

Using coordinate transformation, calculates the sum of finite rotations on a sphere. Requires the latitude and long tude 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 LRFIX

Language - FORTRAN Hardware - IBM 1800/16K words

Produces position fix from station positio. 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 ESTCH, ESTC2, ESTPL

Language - FORTRAN 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. CSTPL converts earth spherical to polar coordinates; not valid for over 200 miles, or over the poles. Input: Starting latitude and longitude, end letitude and longitude. Output: Distance (miles), angle (Jegrees) relative to true North (decimal units).

Michael Moore	Available from originator only
Scripps Institution of Oceanography	
P.O. Box 1529	
La Jolla, CA 92037	Telephone (714) 452-4194

Plan Course and Schedule **CRUIS and Subroutines**

Language - FORTRAN 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 Con DEGFR, DEI		Language - FORTRAN Hardware - IBM 1800
	verts integer degrees and real minut r degrees and decimal minutes.	es to real degrees. DEMI converts decimal degr
	Nichael Moore Scripps Institution of Oceanography P.O. Box 1529	Available from originator only
	La Jolla, CA 92037	Telephone (714) 452-4194
Mercator 1 DMRCT	Degrees	Language - FORTRAN Nardware - IBM 1800
	tude in degrees, gives Mercator proj <u>+</u> 77 degrees.	ected latitude in degrees. Expansion (continue
	Michael Moore Scripps Institution of Oceanograhy P.O. Box 1529	Available from originator only
	La Jolla, CA 92037	Telephone (714) 452-4194
Magnetic MAGFI	Field Components	Lsgusge - FORTRAN Hardware - IBM 1800
tude, lon	gitude, date (years and decimals of	atitude and east longitude. Input: Geoid lat: a year). Output: Magnetic field (gammas), nor d, vertical component of magnetic field.
	Michael Hoore Scripps Institution of Oceanography P.O. Box 1529	Available from originator only
	La Jolla, CA 92037	Telephone (714) 452-4194
Annotated ANNOT	Track on Stereographic Projection	Language - FORTRAN Hardware - CDC 3600/3800/CalComp Plotter
Plots an graphic p	annotated track (bathymetry or magne rojection.	tics data) along a track (navigation) on a ster
	James V. Massingill Environmental Sciences Section Naval Research Laboratory	Available from originator only
	Washington, DC 20375	Telephone (202) 767-2024
Annotates CORBT	Chart	Language - HP FORTRAN IV under RTE Hardware - HP 21005/15K words
tor chart	ition and bathymetry information fro at the position given. This is a r CEANO written by the NRL Propagation	om a disk file and annotates the depth on a Mere revision of the bathymetry processing section of a Branch.
	Robert A. O'Brien, Jr. Shipboard Computing Group, Code 800 Naval Rescarch Laboratory	Availsole from originator only 03
	Washington, DC 20375	Telephune (202) 767-2387

	Language - HP FORTRAN IV under RTE Hardware - HP 21005/10K words		
Plots bathymetric or magnetic data as a function cator chart. The data file (disk) is read, and The dependent variable is then plotted against	the track length or chart distance is calculated.		
Shipboard Computing Group, Code 8003	Available from originator only		
Naval Research Laboratory Washington, DC 20375	Telephone (202) 767-2367		
	Language - HP FORTRAN under RTE Hardware - HP 21005/8K locations/Disk/ Summagraphic Digitizing Tablet		
The operator digitizes the Mercator chart posit longitude; the annotated data value is then ent disk. Input: Information to define chart and	ion, which the program converts to latitude and ered, and position and value are written on the the output of a digitizing tablet.		
Robert A. O'Brien, Jr. Shipboard Computing Group, Code 8003 Naval Research Liburatory	Available from originator only		
· · · · · · · · · · · · · · · · · · ·	Telephone (202) 767-2387		
	Language - HP FORTRAN IV under RTE 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 informa- tion necessary to define a coordinate axis and values from a digitizing tablet.			
Shipboard Computing Group, Code 8003	Available from originator only		
Naval Research Laboratory Washington, DC 20375	Telephone (202) 767-2387		
Plots on Stereographic Chart ANNØT	Language - HP FORTRAN IV under RTE 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. Hodification of Woods Hole program.			
Shipboard Computing Group, Code 8003	Available from originator only		
Nevel Research Laboratory Washington, DC 20375	Telephone (202) 767-2387		
Plots Nevigation Data OCEAN	Language - HP FORTRAN IV under RTE Hardware - HP 2100S/15K background words		

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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.

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Robert A. O'Brien, Jr.Available from originator onlyShipboard Computing Group, Code 8003Naval Research LaboratoryWashington, DC 20375Telephone (202) 767-2387

Long Base Line Acoustic Tracking

Language - HP FORTRAN IV under RTE Hardware - HP 21005

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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 Available from originator only Shipboard Computing Group, Code 8003 Naval Research Laboratory Washington, DC 20375 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 groduct 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, Codu NA Durense Mapping Agency Hydrographic Center Washington, DC 20390

Parametric Map

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Language - FORTRAN II Hardware - UNIVAC 1108

Available from originator only

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 Available from originator only NA Defense Mapping Agency Hydrographic Center Washington, DC 20390

Loran to Geographic and Geographic to Loran Conversion Language - FORTRAN V Hardware - UNIVAC 1108/15K words 1

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.

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Telephone (301) 763-1184

Loran Coordinate Computation

Language - FORTRAN V Harjware - 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 FoxAvailable from originator onlyNavigational Science DivisionDefense Happing AgencyHydrographic CenterWashington, DC 20390Telcphone (301) 765-1184

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

Tel:phone (301) 763-1184

Individual Point Generator for Map Projections

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Language - FORTRAN II Hardware - IBM 7074

Converts geographic positions to discrate 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 Occanographic Office	Available from originator only
Washington, DC 20373	Telephone (301) 763-1449
Individual Point Generator for Distance and Azimuth Computations	Language - FORTRAN II Hardware - 1BM 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.H. Bolton.

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U.S. Naval Oceanograph': Office Washington, DC 20373	Telephone (301) 763-1449

Geodetic Datum Conversion

Language - FORTRAN Hardware - IEM 7074

Transforms reodetic 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.

Drta Systems Office	Available from originator only
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Washington, DC 20373	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 System; Office	Available from originator only
U.S. Naval Oceanographic Office Washington, DC 20373	Telephone (301) 763-1449
wabilington, be 200/0	Terephone (301) 703-1449

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

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Astronomic Latitude

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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

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Sounding Plot

Language - FORTRAN Hardware - CDC 3100/IBM 7074/CalComp plotter

Accepts lorac, loran, or Naydist lane values, plots ship's track and soundings in UTM mode. OS No. 58419. Author - G.R. Bills.

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Single Integration

Language - FORTRAN Hardware - IBM 7074

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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 LM No. 66-36. OS No. 66-36. Author - E.B. Ross.

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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	Copy on file at NODC (Deck, accumentation)
U.S. Naval Oceanographic Office	
Washington, DC 20373	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 Copy on file at NODC (Above report; includes listing)

Telephone (301) 496-8650

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Geodesy, Marine Surveying and Mapping, Nautical and Aeronautical Charting NOS SCIENTIFIC SUBROUTINE SYSTEM Language - FORTRAN IV Hardware - 1BM 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 a.d 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 subroutimes 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 technique. 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 o its divisions by successive approximations for each of the divisions. A table is then s inched for adjusting the decimal seconds to the desired precision to be used in the user's allavie routine. (894 bytes)

ANLIS computes the long distance or geodetic distance and alimuths 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 6000 miles. (5612 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. (6524 bytes)

APCWN computes the state plane coordinates from geographic positions and the inverse for stations in zone 1 of the Alaska plane coordinate system. (4388 bytes)

APOLY computes the American polyconic grid coordinates of a station from geographic positions and the inverse. (4320 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. (2606 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. (1926 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)

GMLLC 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. (2452 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. (5662 bytes)

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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. (6444 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. (5708 bytes)

SODIA 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 bised on equations of the Sodano method for solving the direct position problem. This problem is valid for distances up to 6,000 miles. (4986 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. (3178 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. (7930 bytes)

Milton Stein ADP Programing Branch	Copy on file at NODC (User's Guide; includes listing)
National Ocean Survey, NOA	
6001 Executive Boulevard	•
Rockville, MD 20852	Telephone (301) 496-8026

Computes Geographic Positions

ADP Programing Branch

National Ocean Survey, NOAA 6001 Executive Boulevard Rockville, MD 20852 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.

Cory on file at NODC (listing, documentation)

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 National Ocean Survey, NOAA 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 Copy National Oceanographic Data Center NOAA/EDS Washington, DC 20235 Tele

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, Mollweide homolographic, polar stereographic, Lambert equal-area polar Colligat's equal-area projection of the sphere, azimuthal equidistant, transversed sinusoidal. transversed Mollweide. Author - John O. Ward.

Oceanographic Services Branch 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

State service

Vertical Bar Graphs

James C. Cheap

Department of Water Resources Computer Systems Division 1416 Ninth Street Sacramento, CA 95814 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.

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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

Plotting Program PROFL

Language - FORTRAN IV Computer - CDC 3600

Telephone (714) 452-3526

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, SSEMBLER Hardware - IBM 360 + 370/45K for 360/CalComp Plotter and/or 132 character line printer

Draws a two-dimensional diagram depicting the mutual relationships chong a group of objects whose pairwise similarities are given. Input: A discance 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. Kan Hawaii Institute of Geophysics University of Hawaii at Manoa 2525 Correa Road Honolulu, HI 96822

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Available from originator only

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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 Williams College Department of Geology Williamstown, MA 01267

Available from originator only

Telephone (413) 597-221

X-Y Plots in a Flexible Format MEDSPLOT Language - FORTRAN Hardware - CDC CYBER 74/60K octal words/ CalComp or Zeta Platter

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 dats. 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 online Zeta Plotter connected with a telephone line.

D. Branch Marine Environmental Data Service 580 Booth Street Ottawa, Ont. KIA OH3 Telephone (613) 995-2011

Plots Hydro Cast Data PLOG Language - FORTRAN IV Hardware - IBM 1130/IBM 1627 plotter

Plots the results of hydrographic casts in a format suitable for publication. Produces 8 1/2by 10-inch plots of log (10) depth vs. temperature, salinity, and oxygen.

Pacific Biological StationCopy on file at NODC (documented listing)Fisheries Research Board of CanadaP. O. Box 100Nanaimo, B. C. V9R 5K6

Plots STD Data STP01 Language - FORTR/N IV Hardware - IBM 1...50/IBM 1627 plotter

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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

UNK BOTHER

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.

The Roll of the State of the St

Pacific Biological Station Fisheries Researct soard of Canada P. O. Box 100 Nanaimo, B. C. V9R 5K6 Copy on file at NODC (PSAL1 only, documented listing)

Copy on file at NODC (documented listing)

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Section Plotting

Language - FORTRAN Hardware - CDC 3100/PDP-8/CalÇomp Plotter

The program uses the CDC 3100 plotting subroutines to generate data for the PDF-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 Cal-Comp 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 Available from originator only Bedford Institute of Oceanography P. O. Box 1006 Dartmouth, N. S. B2Y 4A2

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 Available from originator only Woods Hole Oceanographic Institution Woods Hole, MA 02543 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 HIST() 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. PayneAvailable from originator onlyWoods Hole Oceanographic InstitutionWoods Hole, MA 02543Telephone (617) 548-1400

Plot of Frequency Distribution THISTO Language - FORTRAN IV-H dardware - 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 Available from originator only Woods Hole Oceanographic Institution Woods Hole, MA 02543 Telephone (617) 548-1500

Velocity Vector Averages VECTAV Language - FORTRAN IV-H 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 Available from originator only Woods Hole Oceanographic Institution Woods Hole, MA 02543 Telephone (617) 548-1400

Progressive Vectors PROVEC Language - FORTRAN IV-H 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. PayneAvailable from originator onlyWoods Hole Cceanographic InstitutionWoods Hole, MA 02543Telephone (617) 548-1400

Plots Data Along Track TRACK Language - FORTRAN 1V 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 MHOI 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
 Available from originator only

 Woods Hole Oceanographic Institution
 Telephone (617) 548-1400, ext. 469

Profile versus Time or Distance PROFILE

Language - FORTRAN IV Hardware - XDS Sigma 7/4010 32 bit words*/ CalCump or Versatec plotter

Flots in profile versus time or cumulative distance, all WHO1 standard formats or a user-supplied format. Uses standard CalComp software. Input: Data from any device and tun-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

 Wooda Hole Oceanographic Institution
 Telephone (617) 548-1400, ext. 469

Plots Navigation with Any Other Data Type DEEP6

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Language - FORTRAN IV Hardware - Hewlett-Packard minicomputer/ 16K 16 bit words/CalComp plotter

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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 va. 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. 46	69

Lina Printer Plots GRAPH2

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Language - FONTRAN, COMPASS 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 Naval Research Laboratory Washington, DC 20375 Copy on file at NODC (tape, above report)

Magnetic Signatures MAGPLOT Language - FORTRAN Hardware - CDC 3600/CDC 3800/706,768 words/Online 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 Naval Research Laborg Lory Washington, DC 20375

Available from originator only 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 Mercetor Projection	Language - FORTRAN 63 Hardware - CDC 1604/CalComp 165 plotter
time plotting routine. The continent outlines	s on Mercator-projection maps, using a shared- can also be plotted by straight-line segments. 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 sy knowledge of IGS required by user. Fitting of	stem using the Integrated Graphics System. No data into bounds of "good looking" graph.
Peter D. Herstein	Available from originator only
Naval Underwater Systems Center New London, CI 06320	Telephone (203) 442-0771, ext. 2305
Physical Data Plot FRAME	Language - FORTRAN Hardware - CDC 3300
Using arrays of profile data and specification the UGC plotter to provide a profile plot of d signa-t, and sound speed.	a parameters, this subroutine prepares a tape for lepth vs. temperature, conductivity, salinity,
K. Crocker	Available from originator only
Saval Underwater Systems Center Newport, RI 02840	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/

AND A DECK OF THE CASE OF THE CASE OF

Decodes blocked BCD data tapes in NCSDC 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	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	Telephone (202) 763-1449

Produce Contour Charts GRIDIT, REGRIDIT, AUTOMATED CONTOUR

Prove States

Language - FORTRAN Hardware -

3 tape units/CalComp Plotter

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Three programs which enable the user to graphically produce a contour chart by the computerplotter 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. AUTO-MATED 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 DM No. 67-4, "An Automated Procedure for Producing Contour Charts," by Roger T. Osborn, Feb. 1967.

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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.

	Available	from	originator	only	
Geology					
Survey					
Road					
94025	Telephone	(415)	323-8111,	ext.	2174
	Survey Road	: Geology Survey Road	: Geology Survey Road	: Geology Survey Road	Survey Road

Profile Plots, Distance Axis PFLDST Language - FORTEAN 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.

Graig McHendrie	Available from originator only
Office of Marine Geology	
U.S. Geological Survey	
345 Middlefield Road	
Menlo Park, CA 94025	Telephone (415) 323-8111, ext. 2174

Map Plots MAPPLT Language - FORTRAN IV Hardware - IBM 360-67/244K bytes for 7500 nav. cr 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.

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

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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 fins'ly a plot is produced. These routines ignore out of bound points.

Paul Sabol Center for Experiment Design and Data Analysis, NOAA/EDS Washington, DC 2023S

Available from originator only

Telephone (202) 634-7344

X-Y Plots EBTPLT

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Language - FORTRAN IV Hardware - CDC 6600/FR80 Precision Microfilm Recorder ٦,

A generalized x-y plot package. Allows various manipulations of axes as well as special character plotting.

Robert Dennis	Available from originator only
Center for Experiment Design and	-
Data Analysis, NOAA/EDS	
Washington, DC 20235	Telephone (202) 634-7340

Displays VHRR Satellite Data V5DMD

Language - FORTRAN Hardware - CDC 6600/54K words/Digital Muirhead Displayer/NE5S 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	Available from originator only
Service, NOAA Suitland, MD 20233	Telephone (301) 763-8403

Microfilm Plots of VHRR Sattellite Data SVHRR4KM

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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 datermined by a character lookup table. The program is capable of utilizing 3840 digital spots of a possible 4842.

John A. Pritchard National Environmental Satellite	Available from originator only
Service, NOAA	
Suitland, MD 20233	Telephone (301) 763-8403

Vertically Analyzed Contours of Ocernographic Language - FORTRAN 63 Temperatures and Salinities, VACOIS Hardware - CDC 3600/C

Language - FORTRAN 63 Hardware - CDC 3600/CalComp plotter/32% 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 comtours from the surface to 300 m, and the lower section from 300 m to 1000 m. Running time: To analyze and plot concours at intervals of 1 degree C for temperature and 41 parts per thousand for salinity from the surface to 1000 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 CenterCopy on file at NODC (deck, documentation)National Marine Fisheries Service, NOAAP.O. Box 271La Jolla, CA 92037Telephone (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 Copy on file at NODC (documented listing) National Marine Fisheries :ervice, NOAA 75 Virginia Beach Drive Miami, FL 33149

General Mercator Plot

Language - FORTRAN IV Hardware - IbH 360-65, CalComp Plotter/42K bytea

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 Copy on file at NODC documented listing) National Marine Fisheries Service, NOAA 75 Virginia Scach Drive Miami, FL 33149

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.Available from originator onlyShipboard Computing Group, Code 8003Naval Research LaboratoryWashington, DC 20375Telephone (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 Available from originator only Naval Underwater Systems Center New London, CT 06320 Telephone (203) 442-0771, ext. 2970 Scalar Time Series Language - FORTRAN IV TEMPLT7 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 sca-

Computes and plots statistics, histogram, time series, and spectrum for time series of any scaiar quantity. Input: Scalar time series on tape in CDC 6400 binary format; maximum number of inta 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 Harine Environmental Latoratory, NOAA	Available from originator only
3711 Fifteenth Avenue N.E.	
Seattle, WA 98105	Telephone (206) 442-0199
e Series Plotting	Language - FORTRAN 32 Hardware - CDC 3100/FDP-8/CalComp Plotter

The program uses the CDC ³LO 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 31CO in Bedford Institute format. Time is plotted along the X axis (drum movement) and depth along the 2 axis (pen movement). Stations are plotted to the nearest day. Author - D.J. Lawrence. June 1969.

Director	Available from originator only
Bedford Institute of Oceanography F. O. Box 1906	
Dartmouth, N. S. B2Y 4A2	
	Telephone (902) 426-3584

Time Series Analysis Programs TSAP

Time

Language - MS Ft .XAN 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 Gata and convert Fourier coefficients into power and cross spectra. Input: Digitized magnetic tape output from program A TO D and data rards. Output: CalComp plots, printer plots, optiou dump of data tape, magnetic tape of Fourier coefficients, listing of spectra, disk file of spectra. Computer Note B1-C-74-2, May 1974.

P. W. Dobson Bedford Institute of Oceanography P. O. Box 1006	Available from originator only
Lartmouth, N. S. B2Y 4A2	Telechone (902) 426-3584

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Time Series - Analog to Digital A TO D

Language - MS FORTRAN Hardware - CDC 3150/32 K words/1500 tracks on scratch dirk/2 tape units/Crown CI822 tape recorder and Airpax FPS24 dis.riminators for BIO A-D converter

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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.

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

Language - FORTRAN/COMPASS (assembly)

Hardware - CDC 3300/05-3 time-sharing

Telephone (902) 426-3584

Time Series Routines ARAND SYSTEM

operating system/Less than 32 K 4 character words/Graphics: Tektronix 4002 or 4010 graphics (Number in parentheses at end of each abstract is key to references at end of series.) Packard 7200A graphics nighter

at end of series.) Packard 7200A graphics plotter 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 :o 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)

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COMPLT 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 meanlagged product spectral estimation. (1, 7)

CONFIDI determines the multiplicative factors necessary to construct confidence intervals for power spectral estimates found by averaging short modified periodograms, sa 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 ztransform 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)

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DATPLT is a general purpose plot routine for time series data. (3)

DEMODI 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)

FILTERI 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 GENERI 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 57'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)

GENERI 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 cne-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 pletter. The phase estimates must have been computed at equally spaced frequencies and, in order to gererate 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)

PLTFFQ 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 yaxis. 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)

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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)

TCOMPLT, 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 auto-spectral 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)

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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 Yaxis. Also, the plotting of spectral window bandwidth and confidence intervals is pressible. 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 "randor 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 eightcharacter 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 H+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 USPO. 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)

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WINDOWI generates a symmetrical array of weights for use as a data window, as required, for exemple, 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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Director, Computer, Center Oregon State University Corvallis, OR 97331 Available from originator only Telephone (503) 754-2494

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 Copy on file at NODC (listing, documentation) Wormley, Godalming, Surrey, England

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" (IdM 7090); (2) "Local Means and Variances" (IBM 1401).

Trident/ASW LibraryCopy on file at NOBC (listing); documentationArthur D. Little, Inc.(above report) available from NTIS, Order No.35 Acorn ParkAD 601 538/LK, \$4.75 paper, \$2.25 microfiche.Cambridge, MA 0214002140

Time Series Analysis BLACKY Language - FrankAN IV Hardwart - 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 digical analysis by program BLACKY in the study of temperature fluctuations mear the air-sea interface, the wave field at the same point, and the downstream wind velocity.

Naval Postgraduate School	Thesis available from NTIS, Order No. AD 855
Monterey, CA 93940	533/LK, \$3.25 paper, \$2.25 microfiche.

Spectral Analysis of Time Series

Language - FORTRAN IV/ALCOL 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.

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University of Wisconsin-Milwaukee Milwaukee, WI 53201

Center for Great Lakes Studies

Spectra Programs DETRND, AUTCOV, CRSCOV, FOURTR

The Librarian

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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 L. Cross. Adapted (with permission) from a program written at Bell Laboratories by M.J.R. Healy, 1962.

> Hydrodynamics Laboratory Copy on file at NODC (above report) Massachusetts Institute of Technology Cambridge, MA 02139

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

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. Fienaar and J.A. Thomson, March 1969.

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

Fourier Analysis 1101 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 Observa- Copy on file at NODC (deck, documentation) tory Columbia University Palisades, NY 10964

Clister 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, decumentation) Wormley, Godalming, Surrey, England

Probability Distribution WEIBUL

Language - FORTRAN IV 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 Department of Fisheries and Wildlife Sciences Virginis Polytechnic Institute and State University Blacksburg, VA 24061 Available from originator only

Statistics from WHOI Format STATS

Language - FORTRAN IV-H 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. PayneAvailable from originator onlyWood Hole Oceanographic InstitutionVoods Hole, MA 02543Telephone (617) 548-1400

Extended Normal Separator Program ENORMSEP

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Language - FORTRAN IV 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
National Marine Fisheries Service	
P.O. Box 3830	
Honolulu, HI 96812	Telephone (808) 946-2181

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Single Integration

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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

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Telephone (301) 763-1449

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CURVE FITTING

Fits a Smooth Curve SMOOTH Language - FORTRAN IV Hardware - 15M 360-65

Fits a smooth curve between supplied points that passes exactly through those points. Author - Dave Pendleton.

Oceanographic Services National Oceanographic	Copy on file at NODC
NOAA/EDS Washington, DC 20235	Telephone (202) 634-7439

Curve Fitting: Velocity Profile NEWFIT Language - FORTRAN V Hardware - ULIVAC 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 5202 E. Foothill Blvd. Pasadena, CA 91107 Copy on file at NODC (above report)

Least-Squares Curve Fitting in Two, Three,	Languag: - FORTRAN II
and Four Dimensions	Hardwar - CDC 3100
UCF. BCF. TCF	

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 C 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

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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 $X_m = (x_m)$, $x_m \ge 1$,

Marvin J. GoldsteinAvailable from originator onlyNaval Underwater Systems CenterTelephone (203) 442-0771, ext. 2415

Fits Polynomial P3TERM Language - FORTRAN IV Hardware - IBM 360-65

This routine fits a polynomial function $Y(x) = a_0 + a_1x + a_2x^2 + ... a_mx^m$ to the data (x_1, Y_1) , $(x_2, Y_2) \dots (x_n, Y_n)$ 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	Available from originator only
Center for Experiment Design and	
Data Alalysis	
Washington, DC 20235	Telephone (202) 634-7288
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Least-Squares Plot

Language - FORTRAN Hardware - IBM 7074

Fits an n-degree polynomial (max. n = 10) or an exponential function to data points (max. 200), 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	Available from originator only
U.S. Naval Oceanographic Office	
Washington, DC 20373	Telephone (301) 763-1449

Temperature, Salinity Corrections CURVFIT N1S512 Language - FORTRAN Hardware - UNIVAC 1108/DEC PDP-9/6K words

Determines corrections for electronically measured temperature and salinaty 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 equacions, 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

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Bartlett's Curve Fitting

Language - FORTRAN Nardware - 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 Copy on file at NODC (listing, documentation) Wormley, Godalning, Surrey, England

Curve Fitting CRVFT

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Language - FORTRAN II 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 executes by M-curve negative, the latter by M-curve non-negative. In either case "SD" is the actual candard 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. Bedford Institute of Oceanography P. O. Box 1006 Dartmouth, N. S. B2Y 4A2 Copy on file at NODC (deck, documentation)

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Telephone (902) 426-3410

APPLIED MATHEMATICS

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Linear InterpolationLanguage - PL/1LININTHardware - IBM 360-65/144 (hex) bytes

Computes a linear interpolation on fullword fixed binary integers. Author - Robert Van Wie.

Oceanographic Services Branch National Oceanographic Data Center NOAA/EDS Washington, DC 20235 Telephone (202) 634-7439

Lagrangian Three-Point Interpolation LAG3PT Language - PL/1 Hardware - IBM 360-65

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والمدر ماله

Computes a Lagrangian three-point interpolation; calls subroutine LININT. Author - Robert Van Wie.

Oceanographic Services Branch National Oceanographic Data Center	Copy on file at NODC
NOAA/EDS Washington, DC 20235	Telephone (202) 634-7439

Calculates Spline Coefficient SPLCOF Language - FORTRAN IV Hardware - IBM 360-65

Calculates spline coefficient for use by routine SPLINE. Author - Dave Pendleton.

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NOAA/EDS	
Washington, DC 20235	Telephone (202) 634-74 59

Interpolating by Cubic Spline SPLINE

Language - FORTRAN IV 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 National Oceanographic Data Center	Copy on file at NODC
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Program for	Smoothing Data	Language -	FORTRAN IV
Using the	Cubic Spline	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, ..., $n \ge 2$; $x_0 < x_1 < ... < x_n$ and end conditions on either the first or second derivative and a smoothing parameter S ε $(N - \sqrt{2N}, N + \sqrt{2N})$ where N = n+1. Output: Smoothed data values

 9_1 and pointwise approximations to the first and second derivatives at the points x_1 . 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 Longon, CT 06320	Telephone (203) 442-0771, ext. 2415

Solve Algebraic Equations MATRIX

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Language - USASI FORTRAN Hardware - CDC 3300/20K words an a the same and a strategy at

Solves n linear algebraic equations in n unknowns, using Cholesky's method.

Alan T. MasseyAvailable from originator onlyNaval Underwater Systems CenterNewport, RI 02840Telephone (401) 841-4772

Checks Angles TWCPI Language - FORTRAN IV 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 ASSUB, SAS, ASA Language - FORTRAN 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. SAC 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 DSDP/CALC

Language - ALGOL 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 expresions way be defined. The program can save the total working environment for later use. In put: 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 Deep Sea Drilling Project Box 1529 La Jolla, CA 92037

Available from originator only

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 dats for each thermometer. Formulas used are from "On Formulas for Correcting Reversing Thermometers," by F.K. Keyte.

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

Thermometer Correction, Depth Computation HYD1

Le uage - HP ASA Basic FORTRAX~ Haruware - 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	Available from originator only
Woods Hole Oceanographic Institution	
Woods Hole, MA 02543	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 $\dot{N}[d_{n+1}-d_n][(A_{n+1}+A_n)/2]$ 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	Copy on file at NODC (listing, documentation)
Department of Natural Resources Cornell University, Fernow Hall	
Ithaca, NY 14850	Telephone (607; 256~3120

Urweighted Averages AVERAGE

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Language - FORTRAN IV Hardware - IBM 369/5824 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 Frogram Package for Aquatic Ecologists," by Paul J. codfrey, Lois White, and Elizabeth Keokosky.

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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	Available from originator only
Washington, DC 20373	Telephone (301) 763-1449
Julian Day Conversion JDAYWK	Language - FORTRAN IV Hardware - IdM 360-65

Computes the date from the Julian day.

Paul Sabol	Available from originator only
Center for Experiment Design and Data Analysis, NOAA/EDS	
Washington, DC 20235	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 wear, 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	Available from originator only
Center for Experiment Design and	
Data Analysis, NOAA/EDS	
Washington, DC 20235	Telephone (202) 634-7344

Day of the Week NDAYWK Language - FORTRAN IV Hardware - IBM 360-65

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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.

Paul Sabol Center for Experiment Design and Data Analysis, NOAA/EDS	Available from originator only	
Washington, DC 20235	Telephone (202) 634-7344	
Date Calculations DAYWK, NWDAT, NXTDY, YSTDY	Language - FORTRAN Hardware - IFM 1800	

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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).

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Michael MooreAvailable from originator onlyScripps Institution of OceanographyP.O. Box 1529La Jolla, CA 92037Telephone (714) 452-4194

 Julian Day Subroutines
 Language - FORTRAN

 CLEJL, CLJUL
 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).

Michael MooreAvailable from originator onlyScripps Institution of OceanographyP.O. Box 1529La Jolla, CA 92037Telephone (714) 452-4194

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 Copy on file at NODC (listing, documentation) Wormley, Godalming, Surrey United Kingdom

Reduction and Display of Data Acquired at Sea

Language - FORTRAN II Hardware - IBM 1130/Disk/C_1Comp 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 Observ tory Columbia University Palisades, NY 10964

Lamont-Doherty Geological Observatory 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 corracted depth, temperature, salinity, and oxygen, as follows: (1) from protected deep-ses reversing thermometer readings, obtains corrected in situ temperature; (2) from unprotected deep-ses 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) culculates salinity from raw salinity readings; (5) calculates dissolved oxygen concentrations from titrations. Report (unpublished manuscript) by Forma Hantyla, Oct. 1970.

Narine Life Research Group Scripps Institution of Oceanography	Copy on file at NODC (above report)
P.O. Box 1529	
La Jolia, CA 92037	

 Station Data Reduction
 Language - FORTRAN II, FAP

 SYMOP
 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	Available from NTIS, Order No. AD 670 472/LK,
University of Washington	\$5.75 paper, \$2.25 microfiche.
Seattle, WA 98105	

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. Trip+ and S.K. Wong, Dec. 1969.

 Pacific Biological Station
 Copy on file at NODC (above report)

 Fisheries Research Board of Canada
 P. O. Box 100

 Nanaimo, 3. C. V9R 5K6
 V9R 5K6

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
 Telephone (617) 548-1400

Reads NODC Station Data Tape EDIT

Language - FORTRAN IV 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
Department of Oceanography	
Texas A&M University	
College Station, TX 77843	Telephone (713) 845-7432

Converts NODC Format Data to bNDO Format TRANSNODC

Language - FORTRAN IV 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
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 Boite Postale 337
 29273 Brest Cedex, France

 Telephone 80.46.50, telex 94-627

Converts Data to BNDO Format TRANSCOD Language - FORTKAN IV Hardware - XDS Sigma 7/2 tape or disk units

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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

 Centre National pour l'Exploitation des Oceans
 50ite Postale 337

 Boite Postale 337
 29237 Brest Cedex, France

 Telephone 80.46.50, telex 94-627

Reads BNDO Format Data LSTA 1142 Language - FORTRAN IV 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.

 Mr. Stanislas, BNDO
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 Centre National pour l'Exploitation
 des Oceans

 Boite Postale 337
 29273 Brest Cedex, France

 Telephone 80.46.50, telex 94-627

Editing for WHOI format SCRUB

Language - FORTRAN IV-H 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.

 Richard E. Payne
 Available from originator only

 Woods Hole Oceanographic Institution
 Woods Hole, MA 02543

 Telephone (617) 548-1400

Mailing Labels MAILER Language - ALGOL Hardware - Burrough: 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 wrinted.

Peter B. Woodbury	Available from originator only
Deep Sea Drilling Project	
Box 1529	
La Jolla, CA 92037	Telephone (714) 452-3526
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Fortran Access to Scientific Data FASD Language - FORTRAN II, CODAP-1 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 tooi. 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 NOPC station data. Access time is 44 seconds for 1,000 random length observations. A tuble 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 Ccpy on file at NODC (listing) Fleet Numerical Weather Central Monterey, CA 93940

Reproduce and Serialize Deck

Language - FORTRAN IV 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	Available from originator only
Center for Experiment Design and	- .
Data Analysis, NOAA/EDS	
Washington, DC 20235	Telephone (202) 634-7344

Flags Suspicious Data Values EDITQ

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Language - FORTRAN IV 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.

Donald Acheson	Available from originator only
Center for Experiment Design and	•
Data Analysis, NOAA/EDS	
Washington, DC 20235	Telephone (202) 634-7288

Format Free Input Subroutine QREAD

Language - FORTRAN Hardware - IBM 1800

The second s

A format free input subroutine for cards or other sources. Input: Integer array with first eight variables set to determine input.

Michael Moore	Available from originator only
Scripps Institution of Oceanography	
P.O. Box 1529	
La Jolla, CA 92037	Telephone (714) 452-4194

Meters vs. Fathoms MATBL Language - FORTRAN Hardware - IBM 1800/16K words

Produces table of corrected depths in meters vs. raw fathoms.

Michael Moore Scripps Institution of Oceanography	Available from originator only
P.O. Box 1529 La Jolla, CA 92037	Telephone (714) 452-4194

A File-Independent, Generalized Application System, GAS

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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-temperaturadepth (STD) file, ICES ocean surface reference file, and data from cooperative oceanographic research projects.

S	Application / Display	File - Access		Conversion	
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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 iormatted 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 (4JK, 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 'hermocline and mixed layer if desired. Also outputs a tempetature 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).

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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, FORIRAN IV-G).

GASS 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 Morswski (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 - Waiter 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).

Oceanographic Services Branch National Oceanographic Data Center NOAA/EDS Washington, DC 20235 Telephone (202) 634-7439

Other NODC Programs

Hardware - IBM 360-65

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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 edite. 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 Horawski (36K bytes, Assembler).

SDGEOIV reads SD2 master il' 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 Moraws!:i (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 ally the data from the desired Canadian squares. Author - Walter Morawski (36K bytes, Assembler).

SDPASS :etrieves 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:

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XORDER selects XBT dita 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 Freeran (Assembler).

XBFNWC, run after XBF'WSUM, 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 X3T 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 - Fhilip 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-cheracter record with a maximum length of 2500 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 (FOFTRAN).

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 BI cruise file .r the BT geofile. Author - Robert Van Wie (Assembler).

BTLISTC provides edited printout with headings of the NODC geographically-sorted bathythermograph file. Author - Michael Fl: agan (2600 bytes, Assembler).

BTGEOIV reads the bathythermograph file, summarizes the number of stations by month, year, onedegree square, five-degree square, and Marsden square. Author - Charlotte Sparks (14K bytes, PL/1).

Other NOi)C 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 tare, all for only the first 160 records. Author - Rosa T. Washington (Less than 56K bytes, PL/!).

SCMULTI outputs surface current data in any one of the following combinations: (1) edited listing of the entire file; (2) edited listing and puncheu 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 convictely on land. Author - Robert Van Wie (30K bytes, PL/1).

CANWHO 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 IBM 1 Language - FORTRAN 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 Available from originator only Irs C. Darling Center (Marine Laboratory) University of Maine at Orono Walpole, ME 04573 Telephone (207) 563-3146

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	FORTRAN	CCC 1604	WIND COMPUTATION FROM SHIP DESERVATIONS TRUNIND
	FORTRAN	CDC 7600	CPTIMIZED PULTI-LAYER MN MOCEL
	FORTRAN	CDC 3100	CPTIMIZED MULTI-LAYER HN MODEL
	FORTKAN	CDC 6500	PEAN CRIFT REUTINE
75	FORTRAN	CDC 1604	YEAN CRIFT REUTINE
120	FERTRAN	18* 300/65	SEQUENTIAL PLETTING
121	FORTRAN	UNIVAC 1108	
99	FORTKAN	UN!VAC 1108	RAY PATH SC4246
76	FERTRAN	CDC 6500	SEARCH AND RESCUE FLANNING NSAR
	FORTRAN	CDC 66C0	GENERALIZED STECK PREGUCTION MODEL PRODEIT
	FORTKAN	B 6700	GENERALIZED STOCK PRODUCTION MODEL PRODFIT
	FCRTRAN	B 6700	SUPPARIZES WEATHER REPORTS
	FORTRAN	CDC 3100	SOUND SPEED COMPUTATION MODEL SOVEL
	FCRTRAN	CCC 3200	SCUND SPEED COMPUTATION MODEL SOVEL
	FORTRAN	CDC 1604	SCUNU SFEED COMPUTATION MODEL SOVEL
-	FORTEAN	CDC 66C0	DISPLAYS VHRR SATELLITE DATA V5DMD
	FURTEAN	18M 360/195	MICROFILM PLOTS OF VHRR SATELLITE DATA
	FGRTKAN	IBM 1800	BARTLETT'S CURVE FITTING
	FORTPAN	1em 1800	CLUSTER ANALYSIS
		IBM 1890	SATELLITE NAVIGATION
-	FCRTRAN	CDC 3600 CDC 3600	CONVEPTS STO DATA RGEDTP Corrects Sto data ipmod
	FCRTRAN	8 6766	
	FURTRAN	E 670C	LENGTH FREQUENCY ANALYSIS LENFRE
	FORTRAN	6 6763	VIELD PER RECPLIT FOR MULTI-GEAR FISHERIES A GENERALIZED EXPLLITED POPULATION SIMULATOR
	FORTRAN	0633 203	A GENERALIZEC EXPLOITED POPULATION SIMULATOR
	FORTRAN	COC CYBER	X-Y FLUTS IN A FLEXIBLE FORMAT MEDSPLGT
	FCRTRAN	CDC 6400	DATA PGT SYS FOR PHYS CHEM DATA CCEANSY
	FURTRAN	18M 360/40	WATER WAVE TEACHING AIDS PREFI
	FURTHAN	IBM 360/40	WATER WAVE TEACHING AIDS UMAX1
	FORTKAN	124 360/40	WATER WAVE TEACHING AIDS UTMAXE
	FERTRAN	1EM 360/40	MATER WAVE TEACHING AIDS WMAXL
	FORTRAN	18M 360/49	WATER WAVE TEACHING AIDS LENGE
85	FCRTKAN	16* 360/40	WATER WAVE TEACHING AIDS DETAND

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	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTMAX2
	FORTEAN	IBM 360/40	WATER WAVE TEACHING AIDS UCFT1
	FCRTRAN	IBM 36C +0	WATER WAVE TEACHING AIDS WOFTI
	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTCFT1
	FORTRAN	IBM 360/40	WATER MAVE TEACHING AIDS WICFTL
	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS AUTCOV
	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS CRSCGV
85	FGRTRAN	Ie# 360/40	WATER WAVE TEACHING AIDS FEURTR
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS PROFILE
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS REFLI
86	FCRTRAN	18M 360/40	WATER WAVE TEACHING AIDS FORCE AND MOVEPENT
85	FORTRAN	16M 360/40	WATER WAVE TEACHING AIDS EDSIT
	FORTRAN	B 6700	YIELD CURVES WITH LEASTANT RATES TEPF2
	FORTRAN	B 6700	EUPETRIC VIELC TCPF3
	FERTRAN	B 67C0	PIECEWISE INTEGRATION OF YIELD CURVES TOPF4
	FORTRAN	E 6700	PIECENISE INTEGRATION OF VIELD CURVES
	FCRTRAN	B 67C0	CONSTANTS IN SCHAEFER'S MODEL TCPF6
	FORTRAN	B 6700	SCHAEFER LOGISTICS MODEL OF FISH PRODUCTION
	FCRTRAN	E 6700	
	FORTRAN		FITS GENERALIZED STOCK PRODUCTION MODEL TOPPS
		8 6700	BICMETRY-LINEAR REGRESSION ANALYSIS TOSAL
	FCATRAN	B 6700	GENERALIZED WEIGHTED LINEAR REGRESSION
	FORTRAN	B 6700	LINEAR REGRESSION, BOTH VARIABLES
	FORTRAN	B 6700	BIOMETRY-PRECUCT-MLMENT CORRELATION
	FCRTRAN	B 67C0	COOLEY-LONNES MULTAPLE-REGRESSION
	FORTRAN	B 6700	BICMETRY-GCCCNESS LF FIT
	FORTRAN	B 6700	BIGMETRY-BASIC STATISTIC FOR UNGROUPED CATA
	FGRTRAN	B 4700	BIGPETRY-EASIC STATISTIC FCR GROUPED DATA
	FORTRAN	B 6700	BIOMETRY-SINGLE CLASSIFICATION ANOVA
	FORTRAN	B (7:0	BICHETRY-FACTCRIAL ANEVA TOSD2
69	FORTRAN	B 6700	BICMETRY-SUM OF SQUARES STP TOSD3
ó۶	FORTRAN	B 6700	BIOMETRY-STUCENT-NEWMAN-KEULS TEST TCSD4
**	FORTRAN	B 4700	ATCHERDY TEET OF ILL MODELTAN
07	FURIEAN	8 6700	BICMETRY-TEST CF HLMCGENEITY
-	FCKTRAN	E 67C0	BICMETRY-TEST OF EQUALITY
69			BICMETRY-TEST OF EQUALITY
69 70	FCKTRAN	E 67C0	BICMETRY-TEST OF EQUALITY BICMETRY-TUKEY'S TEST
69 70 70	FCRTRAN	E 67C0 E 67C0	BICMETRY-TEST OF EQUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-HALLIS TEST TOSE4
69 70 70 70	FCRTRAN FCRTRAN FCRTRAN	E 67C0 E 67C0 B 6700	BICMETRY-TEST CF EQUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETPY-FISHER'S EXACT TEST TCSE5
69 70 70 70 71	FCRTRAN FCRTRAN FCRTRAN FCRTRAN	E 67C0 E 67C0 B 6703 B 6700	BICMETRY-TEST CF EQUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP
69 70 70 70 71 29	FCKTRAN FCRTRAN FGFTRAN FCRTRAN FCRTRAN FORTRAN	E 67C0 E 67C0 B 6703 B 6700	BICMETRY-TEST CF EQUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS
69 70 70 71 29 28	FCKTRAN FCRTRAN FCRTRAN FCRTRAN FCRTRAN FORTRAN FCRTRAN	E 67C0 E 67C0 E 67C0 E 67C0 B 67C0 B 67C0	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL FCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTION IN ONE-DIMENSIONAL ESTUARY
69 70 70 70 71 29 28 1	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 6709 B 6700 B 67C0 HP 2115A	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-RAUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MEL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP
69 70 70 71 29 28 1 2	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 6709 B 6700 B 67C0 HP 2115A HP 2115A	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-RRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET
69 70 70 71 29 28 1 2 58	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 6709 B 6700 B 67C0 HP 2115A HP 2115A B 6700	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-FISHER'S EXACT TEST TCSE5 NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATER TCPA1
69 70 70 71 29 28 1 2 58 58	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B 67C0 B 67C0	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTION IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTRIBUTION SEPARATOR TCPA1 SPANNER-RECRUIT CUNVE FITTING TCPA2
69 70 70 71 29 28 1 2 58 58 58 58	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B 67C0 B 67C0 B 67C0	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHBUTICN SEPARATOR TCPA1 SPANNER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3
69 70 70 71 29 28 1 2 58 58 58 58 58	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 6700 B 6700	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-RRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL FCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPAI SPANNER-RECRUIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITION ESTIMATION TCPBI
69 70 70 71 29 28 1 2 58 58 58 58 59 55	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-TUKEY'S TEST BICMETRY-FISHER'S EXACT TEST TCSE4 BICMETPY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL FL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING BET NORMAL DISTHIBUTICN SEPARATCR TCPAI SPANNER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPBI ESTIMATE CATCH NUMBERS PERCENT WEIGHT
69 70 70 71 29 28 1 28 58 58 58 55 55	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-FUKEY'S TEST BICMETRY-FISHER'S EXACT TEST TCSE4 BICMETPY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MEL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSICNAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANNER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE CCMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCF NUMBERS PERCENT WEIGHT LENGTH-FRECUENCY DISTRIBUTION
69 70 70 71 29 28 12 58 58 58 59 55 59	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANNER-RECRUIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE CCMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FRECUENCY DISTRIBUTION VCN BERTALANFFY GRUMTH CURVE FITTING TCPC1
69 70 70 71 28 58 58 58 59 59 59 59 60	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPAI SPANER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPBI ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREGUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH UNEQUAL AGE INTERVAL
69 70 70 71 29 28 58 58 58 59 55 56 60 60	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANER-RECRUIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH CURVE AGE INTERVAL VGN BERTALANFFY GRUWTH EQUAL AGE INTERVAL
69 700 701 228 28 588 559 559 600 601	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF ELUALITY BICMETRY-TUKEY'S TEST BICMETRY-FUKEY'S TEST BICMETRY-FRUSKAL-WALLIS TEST TCSE4 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL FCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPAI SPANNER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPBI ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRLWTH CURVE FITTING TCPC1 VON BERTALANFFY GRLWTH CURVE FITTING TCPC4
69 700 719 28 58 55 55 60 60 60 60 64	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EQUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-FISHER'S EXACT TEST TCSE5 SALINITY DISTPIBUTION IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING MET NORMAL DISTHIBUTICA SEPARATCR TCPA1 SPAWNER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 VON BERTALANFFY GRUWTH CURVE FITTING TCFC4 ESTIMATIGN CF LINEAK GROWTH
69 70 70 71 28 28 58 59 55 56 60 60 61 61	FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 67C0 B 6700 B 67C0 B 6700 B 67C0 B 6700 B 67C0 B 6700 B 67C0 B 6700 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAC-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETPY-FISHER'S EXACT TEST TCSE5 BICMETPY-R X C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTION IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTRIBUTION SEPARATOR TCPA1 SPAWNER-RECRUIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITION ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 ESTIMATION CF LINEWS GRUWTH UNEQUAL AGE INTERVAL VON BERTALANFFY GRUWTH CURVE FITTING TCPC4
69 70 70 71 22 58 55 55 60 60 60 64 16 62	FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAC-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-GIMENSICNAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE CCMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUNTH UNEQUAL AGE INTERVAL VGN BERTALANFFY GRUNTH CURVE FITTING TCPC4 ESTIMATION CF LINEAK GRCWTH FISHING POWER ESTIMATION TCPD1 SURVIVAL RATE ESTIMATION TCPD1
69077019812855556600141235555660014123	FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 VON BERTALANFFY GRUWTH CURVE FITTING TCFC4 ESTIMATEGN CF LINEAK GROWTH FISHING POWER ESTIMATION TCP51 SURVIVAL RATE ESTIMATION TCP51 FISHING MCRTALITIES ESTIMATION TCF54
6900701981285555660014666666666666666666666666666666	FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-FRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL FCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANER-RECRUIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 ESTIMATEO CF LINEAK GROWTH FISHING PCWER ESTIPATION TCP51 SURVIVAL RATE ESTIPATION TCP51 SURVIVAL RATE ESTIPATION TCP51 SURVIVAL RATE ESTIPATION TCP51 FISHING MCRTALITIES STIMATION TCP52 RELATIVE YIELC PER RECRUIT
69 70 77 22 55 55 55 60 60 14 66 63 17	FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B 67C0 C C 6 67C0 C C 6 6CC	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-KRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R C TESI CF INDEPENDENCE MAP NUMERICAL MCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANER-RECRLIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 VON BERTALANFFY GRUWTH CURVE FITTING TCFC4 ESTIMATEGN CF LINEAK GROWTH FISHING POWER ESTIMATION TCP51 SURVIVAL RATE ESTIMATION TCP51 FISHING MCRTALITIES ESTIMATION TCF54
69 70 77 22 23 58 55 55 60 60 64 64 23 37 17	FORTRAN FORTRAN	E 67C0 E 67C0 B 67C0 B 67C0 B 67C0 HP 2115A HP 2115A B 67C0 B	BICMETRY-TEST CF EWUALITY BICMETRY-TUKEY'S TEST BICMETRY-FRUSKAL-WALLIS TEST TCSE4 BICMETRY-FISHER'S EXACT TEST TCSE5 BICMETRY-R X C TESI CF INDEPENDENCE MAP NUMERICAL FCL ESTUARY DYNAMICS & KINEMATICS SALINITY DISTPIBUTICN IN ONE-DIMENSIONAL ESTUARY CIGITIZES STC CATA CEEP STD PROCESSING WET NORMAL DISTHIBUTICN SEPARATCR TCPA1 SPANER-RECRUIT CUNVE FITTING TCPA2 WEIGHT-LENGTH CURVE FITTING TCPA3 AGE COMPOSITICN ESTIMATION TCPB1 ESTIMATE CATCH NUMBERS PERCENT WEIGHT LENGTH-FREQUENCY DISTRIBUTION VCN BERTALANFFY GRUWTH CURVE FITTING TCPC1 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 VON BERTALANFFY GRUWTH CURVE FITTING TCPC4 ESTIMATEO CF LINEAK GROWTH FISHING PCWER ESTIPATION TCP51 SURVIVAL RATE ESTIPATION TCP51 SURVIVAL RATE ESTIPATION TCP51 SURVIVAL RATE ESTIPATION TCP51 FISHING MCRTALITIES STIMATION TCP52 RELATIVE YIELC PER RECRUIT
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19 FORT			VOLUME TRANSPORT FUNCTION QFUN
22 FCRT			CO2 AND DC SAT
P/ FORT			SCUNC VELOCITY WILSONS FORMULA WLSND
97 FORT			SCUND VELOCITY WILSONS FORMULA SVELFS
97 FORT		IBM 360/65	SOUND VELOCITY WILSONS FORMULA VELPRS
116 FCRT			VERTICAL BAR GRAPHS
4 FORT			CONSISTENCY OF PHYSICAL AND CHEMICAL DATA
4 FORT			CALCULATION OF THERMOMETRIC VALUES
4 FORT			STATICN DATA SYSTER FINAL VALUES
102 FORT			RAY TRACING KLERER-MAY USER LANGUAGE
135 FORT			FOURIER ANALYSIS LIO1
134 FURT			TWG-DIMENSIONAL AUTOCORRELATION
134 FGRT			TWG-DIMENSICNAL AUTCCORRELATION
118 FOKT	KAN C	DC 3100	SECTION FLOTTING
118 FORT	RAN P	POP-8	SECTION PLOTTING
79 FCRT	RAN C	CDC 3150	CURRENT METER CATA PROCESSING SYSTEM TICE
135 FORT	FAN 1	ICM 7074	LEAST SCUARES PLOT
139 FORT	RAN L	JN 1VAC 1108	TEMPERATURE SALINITY CORRECTIONS CURVEFIT NIS512
139 FORT		PDP-9	BARTLETT'S CURVE FITTING
121 FORT		-	PRODUCES CENTEUR CHARTS GRICIT
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98 FCRT	•		LIGHT AND SCUNC INSTRUCTION B
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144 FCHT			BATHYPETRIC CATA RECUCTION
14 FCRT			
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	-		VERTICAL TEMPERATURE GRADIENTS
137 FORT		LBM 7074	SINGLE INTEGRATICN
111 FORT			GECDETIC DATLM REDUCTION
111 FCRT		le7 7074	GECCETIC POSITION LOMPUTATION AND PLOT
111 FORT			ASTPCNOMIC LATITUDE
112 FGRT		COC 3100	SCUNDING PLCT
112 FORT		IBM 7074	SCUNDING PLCT
112 FURT		IBM 7074	SINGLE INTEGRATION
112 FCRT		CDC 3100	SCCANC INVERSE
89 FORT		18p 7074	SCLAR RADIATION CONVERSION
85 FGRT		16M 7074	WING STRESS
85 FCRT	RAN I	184 7974	TWE-DIMENSIONAL POWER SPECTRUM FOR SWOP II
96 FORT	RAN.	18° 7074	PREDICTION OF VERTICAL TEMPERATURE CHANGE
90 FORT	RAN 1	194 7074	CLEUD CEVER AND DAILY SEA TEMPERATURE
46 FORT	RAN	18× 7074	SEAMCUNT MAGNETIZATION
46 FORT	RAN	16M 7074	CBSERVATION CRAFING GRAVITY
48 FORT		UNIVAC 1108	SEDIMENT SIZE
76 FORT		13# 7074	CURRENT METER TURCLENCE
76 FORT		UNIVAC 1108	WATER DISPLACEMENT CISPLA
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109 FORT		UNIVAC 1108	DISTANCE AND AZIMUTH CIRAZD
105 FCRT		UNIVAC 1108	
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110 FORT		UNIVAC 1105	LORAN CEURDINATE CLMPUTATION
110 FCRT			LCRAN SKYWAVE CERRECTION
15 FCKT		CDC 3200	INTERPOLATION FOR LOEANOGRAPHIC DATA
15 FORT		18º 1620	
75 FGKT		CDC 3300	INTERPOLATION FOR LOCANOGRAPHIC DATA Current 4etef cata create-c
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75 FORT		CDC 3300	CURRENT METER DATA SPECTRUN
93 FORT		CDC 6400	HORIZCNTAL FANGE
120 FGRT		0088 373	LINE FRINTER PLCTS
16 FORT	KAN (CDC 3800	INTERNAL GRAVITY WAVES DISPER

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	FORTRAN		IBM 360/65	NGS SCIENTIFIC SUBACUTINE SYSTEM APOLY
	FORTRAN		18M 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM CGSPC
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	FORTRAN			PLCT TEMP LIST MIXED LAYER DEPTH WEEKPLCT Daily seawater observations
	FOR TRAN FOR TRAN		IBM 360/40	SPECTRA PREGRAMS DETRND AUTCOV CRSCEV FEURTR
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37 16 32 33 33 34 34 35 36 146 125 146 121 123 100 100	FORTRAN FORTRAN	999999955744444444444444444444444444444	UNIVAC 1108 UNIVAC 100 CCC 1604 CCC 3600 CCC 3800	TOWED ARRAY CCNFIGURATIONS TRAPEZCIDAL ARRAY UYNAMICS STD-S/V DATA SZC49 STEADY STATE TRAPEZCICAL ARRAY CONFIGURATIONS ANCHOR LAST-BUCY SYSTEM DEVELOPMENT DYNAMICS CABLE TOWED BUCY CUNFIGURATIONS IN A TURN FREE-FLCATING SPAR-ARRAY CYNAMICS FREE-FLCATING SPAR-BUCY DYNAMICS SHIP SUSPENCEC ARRAY CYNAMICS BUCY-SHIP DYNAMICS BUCY-SHIP DYNAMICS FIXED THIN LINE ARRAY DYNAMICS FIXED THIN LINE ARRAY STEADY STATE CONFIGURATION MARINE CORER DYNAMICS STEADY-STATE BUCY SYSTEM CONFIGURATIONS TOWEC ARRAY CYNAMICS THERPOMETER CORRECIION TOHK2 TIME SERIES PLOTING HYDRCGRAPHIC CATA RECUCTION THO FIVE MACHINE PLOTTING CN MERCATCF PROJECTION VERTICAL SECTICN PHEDICTICN DTSTCV GRASS UNDERWATER ALCUSTICS PREDICTION VFC
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37 16 32 33 33 33 34 34 34 35 35 36 125 125 125 125 125 125 125 125	FORTRAN FORTRAN	0.000000000000000000000000000000000000	UNIVAC 1108 UNIVAC 100 CCC 1604 CCC 3600 CCC 3800	TOWED ARRAY CCNFIGURATIONS TRAPEZCIDAL ARRAY UYNAMICS STD-S/V DATA SZC49 STEADY STATE TRAPEZCICAL ARRAY CONFIGURATIONS ANCHOR LAST-BUCY SYSTEM DEVELOPMENT DYNAMICS CABLE TOWED BUCY CUNFIGURATIONS IN A TURN FREE-FLCATING SPAR-ARRAY CYNAMICS FREE-FLCATING SPAR-BUCY DYNAMICS SHIP SUSPENCEC ARRAY CYNAMICS BUCY-SHIP DYNAMICS BUCY-SHIP DYNAMICS FIXED THIN LINE ARRAY DYNAMICS FIXED THIN LINE ARRAY STEADY STATE CONFIGURATION MARINE CORER DYNAMICS STEADY-STATE BUCY SYSTEM CONFIGURATIONS TOWEC ARRAY CYNAMICS THERPOMETER CORRECIION TOHK2 TIME SERIES PLOTING HYDRCGRAPHIC CATA RECUCTION THO FIVE MACHINE PLOTTING CN MERCATCF PROJECTION VERTICAL SECTICN PHEDICTICN DTSTCV GRASS UNDERWATER ALCUSTICS PREDICTION VFC

101	FORTRAN 63	CDC 3800	GRASS UNDERHATER ACCUSTICS PREDICTION RAFLOT
101	FCRTRAN 63	CCC 3800	GRASS UNDERWATER ACCUSTICS PREDICTION LOSSPLOT
73	ANS FORTRAN	18M 360	ECCLOGICAL STATISTICAL PROGRAMS ECCSTAT
73	ANS FORTRAN	IBM 370	ECOLOGICAL STATISTICAL PROGRAMS ECOSTAT
	PS FORTRAN		TIME SERIES ANALYSIS PROGRAMS TSAP
	MS FORTRAN	CDC 3150	TIME SERIES ANALYSIS PROGRAMS TSAP
126	MS FORTRAN	CCC 3150	TIME SERIES-ANALOG TO DIGITAL A TO D
PL/1			
74	PL/1	IBM 360/168	DRIFT BCTTLE/STATISTICS
74	PL/1	IBM 360/168	DRIFT BETTLE PLOTS
• •	PL/1	IBM 360/165	REFERMAT AND SERT LRIFT BOTTLE DATA
	PL/1	IBM 350/85	DATA PGT SYS FCR PHYS CHEM CATA OCEANSV
		IBM 370/168	
		••••	
	PL/1	10F 370/100	NADECUIAN ANALYSIS OF TOF-14 WIND DATA

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12 PL/1 67 PL/1 151 PL/1 152 PL/1 152 PL/1 152 PL/1 152 PL/1 152 PL/1 153 PL/1 IBM 370/180 IBM 360/65 IBM 360/65 IBM 360/65 IBM 360/65 IBM 360/65 IBM 360/65 MARKEVIAN ANALYSIS WIND DATA SD2CHAR SDGEC IV XBEVALU XBCCNV XBENNC XBTNISUP IBM 360/65 BTGEDIV IEM 360/65 SCHNINE 153 PL/1 153 PL/1 IBM 360/65 SCMULTI 153 PL/1 141 PL/1 141 PL/1 IBM 360/65 DRYLAND IBM 360/65 LINEAR INTERFCLATICN LININT IBM 360/65 IBM 360/65 LAGRANGIAN THREE PLINT INTERPOLATION LAG3PT FILE INCEPENCENT GEN APP SYS GAS GAS THERM 150 FL/1

MISCELLANECUS

الدوجين بالمجي المعاودي محاليهم الهمري معادا المحارات الأمان

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104 MAD	IBM 7090	GENERAL MAP FREJECTION
104 MAD	18M 7090	FINITE PAP PROJECTION DISTORTIONS
80 MAD	IBM 7090	THECRETICAL RACIAL TIDAL FORCE
53 NAP	IBM 7094	PHYTOPLANKTON NUMBERS VOLUPE SURFACE AREA
114 SPS	IBM 1620	CCMPUTES GECGRAPHIC PESITIONS
114 SPS	IBM 1620	LORAN C VERSICN2

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61	FORTRAN		8	6700	FISHING POWER ESTIMATION TOPOL
71	FORTRAN		8	67 C C	BIGMETRY-9 X C TEST OF INDEPENDENCE MAP
60	FORTRAN		8	6790	VON BERTALANFFY GREWTH CURVE FITTING TEPEI
60	FORTRAN		8	6700	VON BERTALANFFY GREWTH UNEQUAL AGE INTERVAL
60	FCRTRAN		B	6700	VON BERTALANFFY GRENTH EQUAL AGE INTERVAL
70	FGRTRAN		8	6700	BICMETRY-TUKEY'S TEST
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131 FOR	TRAN	202	330	07	CS3	TIME	SERIES	ARAND	TCRCPLT
	TRAN	CDC	310	0/	053	TIME	SERIES	ARAND	IFCRM1
	TRAN	COC			CS3	TIPE	SERIES	ARAND	IFORM2
	TRAN	202			053	TIME	SERIES	ARAND	TIMSPC
	TRAN	222			CS3	TIME	SERIES	ARAND	TLOGPLT
	TRAN	CDC	-		CS3	TIME	SERIES	ARAND	INGIZT
	TRAN	CDC			CS3	TIME	SERIES	APAND	TPHAPLT
	TRAN	COC			CS3	TIME	SERIES	ARAND	TPLTFRQ
	RTRAN	CDC			053	TIME	SERIES	ARAND	TPLTSPC
	RTRAN	222			CS3	TIME	SERIES	AFAND	TRISMC
	TRAN	COC	-	-	053	TIME	SERIES	ARAND	PCLRT
	TRAN	CDC			GS3	TIME	SERIES	ARAND	PCLYDY
	RTRAN	232			CS3	TIME	SERIES	ARAND	PRCPLT
	RTRAN	000	_	-	ČS3	TIME	SERIES	ARAND	FSORT
	RTRAN	CDC			CS3	TIME	SERIES	ARAND	RANDM
	RTRAN	CDC			ČŠ3	TIPE	SERIES	ARAND	RCTFFT
	RTRAN	COC	-	-	053	TIME	SERIES	ARAND	RESPCN
	RTRAN	233			CS 3	TIME	SERIES	ARAND	NEVERS
	RTRAN	CDC	_	-	CS3	TIME	SERIES	ARAND	APLACE
	RTRAN	CDC		-	053	TIME	SERIES	ARAND	RVERS
	RTRAN	202			CS3	TIPE	SERIES	FRAND	SARIT
	RTRAN	COC			C\$3	TIME	SERIES	ARAND	SERGEN
130 FO		CDC			CS3	TIPE	SERIES	ARAND	SHAPE
	RTRAN	CDC			253	TIME	SERIES	ARAND	SINTR
	RTRAN	ČČČ	-		053	TIME	SERIES	ARAND	SMG
	RTRAN	CDC			'CS3	TIME	SERIES	ARAND	SPEC
	RTRAN	CDC			253	TIME	SERIES	ARAND	SPECT1
130 FO		CDC			053	TIME	SERIES	ARAND	SPECT2
	RTRAN	CDC			253	TIPE	SERIES	AFANC	FFIN
	RTRAN	000			CS3	TIME	SERIES	ARAND	FOLD
	RTRAN	CCC			1053	TIME	SERIES	ARAND	FCURTR
129 FO		CDC			/CS3	TIME	SERIES	ARAND	FEUSPC
	RTRAN	CDC			CS3	TIME	SERIES	ARAND	FCUSPC1
	RTRAN	CDC	-		CS3	TIPE	SERIES	ARAND	FOUSPC2
	RTRAN	Cac			CS3	TIME	SERIES	ARAND	FRESPON
	ATRAN	COC			1053	TIME	SEPIES	ARAND	UAPH
129 FC		CDC			CS3	TIME	SERIES	ARAND	GENER1
	ATRAN	CDC		-	053	TIME	SERIES	ARAND	GENER2
-	RTRAN	ČČČ			/053	TIME	SERIES	PRAND	GENER3
	RTRAS	CCC			/C\$3	TIME		ARAND	LEGFLOT
	ATRAN	CDC		-	CS3	TIME	SERIES	ARAND	NC12T
	FTRAN	CCC			CS3	TIME	SERIES	ARAND	PFAPLT
	RTRAN	CDC			CS3				FLTFCR
	FTEAN	CDC			CS3		SERIES	ARAND	FLTFRG
129 FC	RTRAN	CDC	33	100	/[\$3	TIME	SERIES	ARAND	PLTCPG
	RTRAN	CDC	33	100,	/ĊS3	TIME	SERIAS	ARAND	LCCRR
	RTRAN	000	33	100.	/653	TIME	SERIES	ARAND	LONPLT
127 FC	RTRAN	CDC	33	Co.	/C\$3	TIME	SERIES	ARAND	CCMFLCT
127 50	FTRAN	coo	33	100	1653	TIME	SERIES	SFAND	
	RTRAN	C00	: 33	000	/CS3	TIME	SERIES	ARAND	
	DRTKAN	CCC			/CS3		SERTES	ARAND	LGNMÜDE
127 FC	RTRAN	Cac	: 33	00.	/cs3	TIME	SERIES	ARAND	· · ·
	DRTRAN	Cac	: 3	300	/cs3	TIME	SERTES	ARANC	CSTR
	RTRAN	CDO			/053		SERIES	ARAND	LPEES
	RTRAN	CDO	; 3:	300.	/053	TIME	SERIES	ARAND	CPLT1
	RTRAN	CD	: 33	300	/053	T T ME	E SERIES	S ARAND	
	DRTRAN	CCC	; 33	300	/csa	TIME	SERIES	5 APAND	CRCPLT
127 FC	KTRAN	C00	; 33	300	/0\$3	1 TIME			
127 F	OKTRAN	000	: 3.	300	/ŭS3	6 TIM	E SERIES	S ARAND	LUSID

127 FORTRAN	CDC 3300/053	TIME SERIES ARAND CUSFC
128 FORTRAN	CCC 3300/CS3	TIME SERIES ARAND CZT
128 FORTRAN	CCC 3300/CS3	TIPE SERIES ARAND DATPLT
128 FORTEAN	CDC 3300/CS3	TIME SERIES ARAND LEMC'.
128 FORTRAN		TIME SERIES ARANG DEMY 2
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		TIPE SERIES ARAND ACFF.
126 FORTRAN		
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126 FORTRAN		TIPE SERIES ARAND ACRPLT
126 FORTRAN		TIPE SERIES APANG ALIGN
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126 FORTRAN		TIME SERIES ARAND ARMAP
126 FORTRAN		TIME SERIES ARAND AUTC
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82	FORTRAN	ĪV	CDC	6600		HURRICANE STORF SUNGE FORECASTS SPLASH II
57	FCRTRA	N	COC	6600		GENERALIZED STOCK PRODUCTION MODEL PRODFIT
38	FCR THAN	IV	CDC	6600		CONVECTION INVARIABLE VISCOSITY FLUID CONVEC
17	FORTKAN		CDC	6600		INTERNAL WAVE CSCILLATIONS ZMODE
2	FCRTRAN	I۷	232	6600		STD DATA FRECESSING
	FORTKAN			6600		SPECIES DIVERSITY JCB
52	FORTRAN	IV	COC	6600		PREDUCTIVITY ECEPRLD
24	FORTRAN	EV	CDC	7620		MULTI-LAYER FYCRODYNAMICAL-NUMERICAL MCDEL
63	FCRTRAN	IV	CDC	7600		FRENCH SPECTRC-ANGLLAR WAVE MODEL
75	FORTRAN	1	CuC	7600		CPTIMIZED FULTI-LAYER HN MCGEL
17	FORTKAN	•	CDC	7600		INTERNAL WAVE OSCILLATIONS ZMODE
117	FORTRAN	•	CDC	CYBER		X-Y PLOTS IN A FLEXIBLE FORMAT MEDSPLCT
- 4	FERTRAN	VI.	000	CYBER	74	DAILY SEAMATER COSERVATIONS

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125	FCRTRAN 32	POP-8	TIME SERIES PLOTTING
3	FORTRAN II	PDP-8	PLOTS STATICN PCSTTIONS
3	FORTRAN 11	PCP-8	PLOT THETA-S CURVIS
118	FORTRAN	PDP-8	SECTION PLUTTING
5	FCRTRAN II	PCP 8E	MASS TRANSPERT AND VELOCITIES GEOMASS
	FORTRAN	PDP-9	"ARTLETT'S CURVE FITTING
5	FORTRAN IV	PDP 10	STATICN DATA THIRP
-	FORTRAN LV	PDP 10	THERMCMETER CORRECTION THERMOMETRIC DEPTH
	FORTRAN	P0P-11	GENERAL PUPPCSE EDITOR DASEC
	FORTRAN	PDP-11	TIME SERIES INTO PROFILES CHSCHP
	FORTRAN	P0P-11	AANDERAA CURRENT METER DATA AACAL
	FORTRAN	P0P-11	CURRENT PROFILER DATA MK2CAL
20	FCRTRAN	PDP-11	APPENCS NEW CATA TL FILE DERIVE

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139 FOR	TRAN I	1	GE .	22	5
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143	FORTRAN		HP	2100	THERMEMETER CORRECTION DEPTH COMP HYDI
8	FORTRAN	11	HP	2100	STATICN DATA HYE2
3	FORTRAN	ÍV.	HP	2100A	STC TABLES AND PLOTS STO
16	FORTRAN	11	HP	21005	THERMCMETER CATA FILE MANDLER THERMC
135	FORTRAN	I۷	HP	21005	LORAN OR CHEGA CONVERSION GEPOS
107	FCRTRAN	IV	HP	21005	ANNCTES CHART
108	FORTRAN	ÎV.	HP	21005	BATHYPETRIC CR PAGNETICS CHART PROFL
108	FORTRAN	١v	HP	21005	MERCATOR CHAFT DIGITIZATION ANTRK
108	FORTRAN	L٧	HP	21005	BATHYPETRIC CHART LIGITIZATION DOBTH
108	FORTHAN	Iv .	HP	21005	PLCTS ON STERECGRAFFIC CHART ANNET
108	FCRTRAN	I۷	HP	21005	PLETS NAVIGATION CATA LOEAN
16	FORTRAN	IV	HP	21005	THERMEMETRIC EEPTH CALCULATION CAST
124	ASSEMBLY	1	HP	21005	PLOTTER COMMANCS FLOT DVRIC
109	FORTRAN	11	HP	21005	LONG EASE LINE ACCUSTIC TRACKING
2	FORTRAN		HP	2115A	STC PRCCESSING NET
1	FORTRAN		HP	2115A ·	DIGITIZES STC CATA CEEP
105	FORTRAN	I۷	HP	3100A	CRUISE TRACK THERC
32	EASIC		HP	9830A	UNMANNEC FREE-SWIMMING SUBPERSIBLE
32	BASIC		HP	9830A	UNPANNED FREE-SWIMMING SUBMERSIELE HETEL LEAD
31	BASIC		HP	98304	UNMANNED FREE-SWIMPING SUBMERSIBLE PLOT
120	FORTRAN	I۷	HP	MINI	PLCTS NAVIGATION WITH ANY CTHER DATA TYPE LEEPS

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51	FORTHAN I	V IBH	360	TOXICITY EICASSAY PROBIT ANALYSIS
54	FORTRAN I	V IBM	360	SUCCESSION
54	FERTRAN I	v 18*	360	SPECIES ABUNCANCE
134	FORTRAN I	V IBM	360	TIPE SERIES ANALYSIS BLACKY
24	FORTRAN I	MSI V	360	SINGLE LARGE HYDROLYNAMICAL-NUMEFICAL MCDEL
143	FCRTRAN I	V IEM	360	AREAL CONCENTRATION INTEGRATE
143	FORTRAN I	V IEM	360	UNNEIGHTED AVERAGES AVERAGE
73	ANS FORTR	AN TOM	360	ECCLEGICAL STATISTICAL PREGRAMS ECESTAT
26	FORTRAN I	v Ie*	360	PATHEPATICAL WATER QUALITY PODEL FOR ESTUARIES

26 FORTRAN IV	IBM 360	CONFUTATION OF FLOW THROUGH MASONBORD INLET NO
26 FORTRAN IV	18M 360	CIRCULATION IN PAPLICE SOUND
116 FCRTRAN	IBN 360	DENDREGRAPH
25 FORTRAN IV	IBM 360	CYNAMIC DETERMINISTIC SIMULATION SIMUDELT
54 FORTRAN IV	IBM 360	PIGPENT PATIC
13 BASIC	IBM 360	ENVIRENMENTAL DYNAMICS SUBREUTINES OCEANLIB
13 BASIC	IBM 360	GECSTRCPHIC CURRENT
22 FORTRAN	18M 360	CO2 ANG 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 MODEL OF COASTAL UPWELLING
86 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIGS PROFILE
86 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS REFLI
86 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FORCE AND POVEPENT
135 FORTRAN IV	IBM 360/40	SPECTRA PROGRAMS DETRND AUTOOV CRSCCV FOURTR
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS PRCF1
85 FORTRAN	18M 360/40	WATER WAVE TEACHING AIDS UMAXL
85 FCRTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTPAX1
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WMAX1
85 FORTRAN	IBM 360/40	WATER NAVE TEACHING AIDS LENGE
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS DETRND
85 FCRTRAN	IBM 360740	WATER WAVE TEACHING AIDS WTPAX2
85 FORTRAN	18M 360/40	WATER WAVE TEACHING AIDS UCFT1
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WOFTL
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTCETI
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTCFT1
85 FORTRAN	18# 360/40	WATER WAVE TEACHING AIDS AUTCOV
85 FORTRAN	18M 360/40	NATEP WAVE TEACHING AIDS CRSCOV
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FEURTR
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS EDSIT
115 FORTRAN IV	I6# 360/40	MAP PROJECTIONS AND GRIDS MAP
4 COPOL	IBM 360/50	CONSISTERCY OF PHYSICAL AND CHEMICAL DATA
4 FORTRAN	IBM 360/50	CONSISTENCY OF PHYSICAL AND CHEMICAL DATA
122 FORTRAN IV	18M 360/61	PROFILE PLCTS TIME AXIS PRCFL3
122 FCRTRAN IV	18# 367-61	PROFILE PLOTS DISTANCE AXIS PFLDST
122 FORTRAN IV	IB# 36C/61	MAP FLCTS FAFFLT
41 FERTRAN IV	IBM 363/65	PLCTS PROFILES OF DATHYMETRY AND MAGNETIC
150 FORTRAN IV	16M 360/65	FILE INCEPENCENT GEN APP SYS GAS GASCIPES
150 FERTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASSAMPC
150 FORTRAN IV	IBM 360/65	FILE INCEPENCENT GLN APP SYS GAS GASEINV
150 FERTRAN IV	IBM 360/65	FILE INCEPENCENT GEN APP SYS GAS GASCCI
150 FORTRAN IV	IBM 360/65	FILE INDEPENCENT GLN APP SYS GAS GASVPRT
150 FERTRAN IV	IBM 360/65	FILE INCEPENCENT GEN APP SYS GAS GVARCFRM
150 FORTRAN IV	IRM 360/65	FILE INDEPENCENT GEN APP SYS GAS CANADA
150 FERTRAN IV	16M 360/65	FILE INCEPENCENT GEN APP SYS GAS GAS
150 FORTRAN IV	104 360/05	
	104 360/25	FILE INCEPENCENT GEN APP SYS GAS GASVASLM
150 PL/1	104 360/25 184 360/65	FILE INCEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM
150 PL/: 150 ASSEMBLEP	184 360/25 184 360/25 184 360/65	FILE INCEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INCEPENCENT GEN APP SYS GAS GASTHERM
150 PL/1 150 ASSEMBLEP 150 ASSEMBLEP	10* 360/65 10M 360/65 10# 360/65 16# 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVASLM File Indepencent gen app sys gas gas therm File Indepencent gen app sys gas gastherm File Indepencent gen app sys gas incata
150 PL/1 150 ASSEMBLEP 150 ASSEMBLER 150 ASSEMBLER	10* 360/65 18# 360/65 18# 360/65 18# 360/65 18# 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INDEPENCENT GEN APP SYS GAS GASTHERM FILE INDEPENCENT GEN APP SYS GAS INCATA FILE INDEPENCENT GEN APP SYS GAS CREATE
150 PL/: 150 ASSEMBLEP 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER	124 360/85 18M 360/65 18M 360/65 18M 360/65 18M 360/65 18M 360/65	FILE INCEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INCEPENCENT GEN APP SYS GAS INCATA FILE INCEPENCENT GEN APP SYS GAS INCATA FILE INCEPENCENT GEN APP SYS GAS MCNTH6C
150 PL/: 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER	124 360/25 124 360/25 124 360/65 124 360/65 134 360/65 134 360/65 184 360/65	FILE INCEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INCEPENCENT GEN APP SYS GAS GASTHERM FILE INCEPENCENT GEN APP SYS GAS INCATA FILE INCEPENCENT GEN APP SYS GAS CREATE FILE INCEPENCENT GEN APP SYS GAS CHEMBO
150 PL/1 150 ASSEMBLEP 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER	124 360/65 184 360/65 184 360/65 184 360/65 184 360/65 184 360/65 184 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INDEPENCENT GEN APP SYS GAS GASTHERM FILE INDEPENCENT GEN APP SYS GAS INCATA FILE INDEPENCENT GEN APP SYS GAS CREATE FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CHEMBO
150 PL/1 150 ASSEMBLEP 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER	124 360/65 18M 360/65 18M 360/65 18M 360/65 18M 360/65 18M 360/65 18M 360/65 18M 360/65	FILE INCEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INCEPENCENT GEN APP SYS GAS GASTHERM FILE INCEPENCENT GEN APP SYS GAS INCATA FILE INCEPENCENT GEN APP SYS GAS CREATE FILE INCEPENCENT GEN APP SYS GAS COMMBO FILE INCEPENCENT GEN APP SYS GAS CEPTHEC FILE INCEPENCENT GEN APP SYS GAS LATLCNEO
150 PL/1 150 ASSEMBLEP 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER	124 360/65 12M 360/65 12M 360/65 13M 360/65 13M 360/65 13M 360/65 12M 360/65 12M 360/65 12M 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INDEPENCENT GEN APP SYS GAS GASTHERM FILE INDEPENCENT GEN APP SYS GAS INCATA FILE INDEPENCENT GEN APP SYS GAS CREATE FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS LATLCNEO FILE INDEPENCENT GEN APP SYS GAS GASCHER
150 PL/1 150 ASSEMBLEP 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 20 ASSEMBLEF	124 360/65 124 360/65 124 360/65 134 360/65 134 360/65 134 360/65 134 360/65 124 360/65 124 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INDEPENCENT GEN APP SYS GAS GASTHERM FILE INDEPENCENT GEN APP SYS GAS INCATA FILE INDEPENCENT GEN APP SYS GAS CREATE FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CEPTHEC FILE INDEPENCENT GEN APP SYS GAS LATLCNEO FILE INDEPENCENT GEN APP SYS GAS CASCREE FILE INDEPENCENT GEN APP SYS GAS CASCREE FILE INDEPENCENT GEN APP SYS GAS CASCREE FILE INDEPENCENT GEN APP SYS GAS CASCREE TEMFEFATUPE CIFFERENCE CALCULATIONS
150 PL/1 150 ASSEMBLEP 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER 150 ASSEMBLER	124 360/65 12M 360/65 12M 360/65 13M 360/65 13M 360/65 13M 360/65 12M 360/65 12M 360/65 12M 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVASLM FILE INDEPENCENT GEN APP SYS GAS GAS THERM FILE INDEPENCENT GEN APP SYS GAS GASTHERM FILE INDEPENCENT GEN APP SYS GAS INCATA FILE INDEPENCENT GEN APP SYS GAS CREATE FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CHEMBO FILE INDEPENCENT GEN APP SYS GAS CEPTHEC FILE INDEPENCENT GEN APP SYS GAS LATLCNEO FILE INDEPENCENT GEN APP SYS GAS CASCREE FILE INDEPENCENT GEN APP SYS GAS CASCREE FILE INDEPENCENT GEN APP SYS GAS CASCREE FILE INDEPENCENT GEN APP SYS GAS CASCREE TEMFEFATUPE CIFFERENCE CALCULATIONS

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 CATE CONVERSION ROUTINES CESLUJ
144 FORTRAN IV	IBM 360/65	DAY OF THE WEEK NCAYWK
124 FORTRAN IV	IBM 360/65	GXYGEN PECSPEATE DENSITY PLCTS
124 FORTRAN IV	IEM 360/65	GENERAL MERCATOR PLOT
114 FORTRAN IV	IBM 360/65	NDS SCIENTIFIC SUBACUTINE SYSTEM LCRAN
114 FORTPAN IV	184 360/65	NGS SCIENTIFIC SUENCUTINE SYSTEM CHEGA
114 FORTRAN IV	IBM 360/65	NCS SCIENTIFIC SUBACUTINE SYSTEM SCCIN
114 FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBMOUTINE SYSTEM SCOPN
114 FERTRAN IV	IBM 360/65	NGS SCIENTIFIC SUEROUTINE SYSTEM TPFIX
114 FORTRAN IV	19M 300/65	NUS SCIENTIFIC SUBRCUTINE SYSTEM UTMCD
138 FORTRAN IV	IEM 360/65	FITS A SMCCTH CURVE
18 FORTRAN	IBM 360/65	ISENTROPIC INTERPOLATION
18 ASSEMBLER	IBM 360/65	POTENTIAL TEMP AND/OR DENSITY POTDEN
18 FCRTRAN	IBM 360/65	SIGPAT
18 FORTRAN IV	IBM 360/65	DYNAMIC DEPTH ANCMALY CYANCM
18 FORTRAN	IBM 360/65	SALINITY FREE CONDUCTIVITY T P SALINE
78 ASSEMBLER	IBM 360/65	SURFACE CURRENT SUMMARY SUFCUR
148 FORTRAN IV	IGN 360/65	FLAGS SUSPICICUS DATA VALUES EDITO
38 FORTRAN IV	1BM 360/65	GRAVITATIONAL ATTRACTION TWO-DIMENSIONAL BODIES
153 ASSEMBLER	18M 360/65	RETXET
153 ASSEMBLER	IBM 360/65	XBTCCNV
153 ASSEMBLER	18M 360/65	RETET
153 ASSEMBLER	IBM 360/65	BTLISTC
153 FORTRAN IV	IEM 360/65	XBSELECT
153 FORTRAN IV	18M 360/65	XBPSINV
153 FORTRAN IV	IBM 360/65	XBGEOSUF
153 FORTRAN IV	184 360/65	CANNPC
153 PL/1	IBM 360/65	BTGECIV
153 PL/1	IBM 360/65	SCHNINE
153 PL/1	IEM 360/65	SCHULTI
153 PL/1	IBM 360/65	DRYLAND
103 FCRTRAN IV	IBM 360/65	ASTRCHOMIC PESITION AZIMUTH METHED
23 FORTRAN IV	IBM 360/65	WATER CHEMISTRY DILLECTRIC CONSTANT
113 FCRTRAN IV	IBM 360/65	NCS SCIENTIFIC SUBROUTINE SYSTEM ANGLE
113 FCRTRAN IV	184 360/65	NOS SCIENTIFIC SUBACUTINE SYSTEM ANLIS
113 FORTRAN IV	IBM 360/65	ACS SCIENTIFIC SUBACUTINE SYSTEM APCTN
113 FORTRAN IV	IE* 360/65	NOS SCIENTIFIC SUBNCUTINE SYSTEM APCWN
1)3 FERTRAN IV	IHM 360/65	NCS SCIENTIFIC SUBACUTINE SYSTEM APOLY
113 FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBACUTINE SYSTEM CGSPC
113 FORTRAN IV	IBM 360/65	NCS SCIENTIFIC SUBACUTINE SYSTEM CUBIC
113 FORTRAN IV	16M 360/65	NOS SCIENTICIC SUBROUTINE SYSTEM EXCEB
113 FERTRAN IV	IEN 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM GML1C
113 FORTRAN IV	IBM 360/65	NGS SCIENTIFIC SUBRCUTINE SYSTEM HIFIX
19 FORTRAN	IBM 360/65	VOLUME TRANSPERT FUNCTION CFUN
15 FORTRAN IV	IBM 360/65	PCTENTIAL TEPP AND CENSITY PEDENS
19 FCRTRAN IV	IB* 360/65	VCLUME TRANSPORT VULTRN
19 FORTRAN IV	18M 360/65	CCMFUTES PRESSURE PRESSR
139 FORTRAN IV	IBM 360/65	FITS PELYNEPIAL PSIERM
136 FCRTRAN IV	18M 360/65	EXTENDED NORMAL SEPARATOR PROGRAM ENCRMSEP
25 FORTRAN IV	IBM 360/65	MIT SALINITY INTRUSION PROGRAM
103 FORTRAN IV	IEM 360/65	PLGTS MAPS GRIDS TRACKS MAP
152 ASSEMBLER	IBM 360/65	SDFRT2
152 ASSEMBLER 152 Assembler	IBM 360/65	SDSELECT SD2MSTCT
172 8332551256		
	18M 36C/65	
152 ASSEMBLER	IBM 360/65	SD2SAMP

160 40000000	TOM 3/0//E	CD1/CO1
152 ASSEMBLER	IBM 360/65	CRUCON
152 ASSEMBLER	IBM 360/65	CCCCCCNV
152 ASSEMBLER	IBM 360/65	SUPERSEL
	IBM 360/65	SOPASS
	IBM 360/65	XCPDER
152 ASSEMBLER	IBM 360/65	XETCCUNT
152 FORTRAN	IBM 360/65	XBTGKCUT
152 PL/1	IBM 360/65	SDGECIV
152 PL/1	IBM 36C/65	XBEVALU
152 PL/1	IBM 360/65	XBCCNV
152 PL/1	18# 360/65	XBFNWC
152 PL/1	18M 360/65	XBTNNSUF
142 FORTRAN IV	IBM 360/65	CHECKS ANGLES THOPI
122 FORTRAN IV	IBM 360/65	PLCTS SCATTERGRAM SCTGP4 SCTGMS
22 FORTRAN IV	164 360/65	
25 FORTRAN IV	18M 360/65	PERCENTAGE SATURATION OF DAYGEN IN ESTUARY
		MIT SALINITY INTRUSICN PROGRAM
115 FORTRAN IV	IBM 360/65	CCMPUTE GREAT CIPCLE PATH GCIRC
144 FORTRAN IV	IBM 360/65	JULIAN DAY CONVERSION JDAYHK
144 FORTRAN IV	IBM 360/65	JULIAN CATE CONVERSION ROUTINES JULDAY
7 FORTRAN IV	IBM 360/65	REAC CALC INTERP STATION DATA CAPRICORN
7 FORTRAN IV	IBM 360/65	STATION DATA CALCULATIONS F3
147 FCRTRAN IV	IBM 360/65	REACS NODC STATION CATA TAPE
8 FURTRAN IV	IBM 36C/65	PLCTS STATICN CATA PLTEDT
8 FÜRTRAN IV	IBM 360/65	CALCULATES STATION DATA SECPG
97 FORTRAN	18M 360/65	SCUNG VELOCITY WILSONS FORPULA WESNO
97 FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA SVELFS
97 FCRTRAN	TBM 360/65	SCUND VELCCITY WILSONS FORFLLA VELPRS
141. PL/1	IBM 360/65	LINEAR INTERFELATION LININT
141 PL/1	IBM 360/65	LAGRANGIAN THREE POINT INTERPOLATION LAGEPT
141 FORTRAN IV		CALCULATES SFLINE LCEFFICIENT SPLCCF
141 FORTRAN IV	IBM 360/65	INTERPOLATING BY CUBIC SPLINE
151 FORTRAN LY	18M 360/65	FILE INCEPENCENT GEN APP SYS GAS ALTERGAS
151 FORTRAN IV	IBM 360/65	FILE INCEPENCENT GEN APP SYS GAS GASB
151 FURTRAN IV	18M 360/65	
151 FORTRAN IV		FILE INDEPENCENT GEN APP SYS GAS NCDCSQ
	IBM 360/65	FILE INCEPENCENT GEN APP SYS GAS NAMES
151 FORTRAN IV	IBM 300/65	FILE INDEPENCENT GEN APP SYS GAS SC2 GAS
151 ASSEMBLER	IBM 360/65	SDRETV
151 ASSEMBLER	IBM 360/65	SD2TCSC1
151 PL/1	IBM 360/65	SD2CHAR
41 FORTRAN IV	18M 360/65	PARINE GECPHYSICAL CATA REDUCTION
83 FORTRAN IV	IBM 360/75	HAVE ECTTOM VELOCITY
4 COBOL	IBM 360/85	DATA PGT SYS FOR PHYS CHEP DATA CCEANSV
4 PL/1	IBM 360/85	DATA FGT SYS FOR PNYS CHEM CATA DCEANSV
84 FORTRAN	IBM 360/165	HAVE INTERACTION WITH CURRENT CAPGRAY
74 PL/1	IBM 360/168	DRIFT BOTTLE/STATISTICS
74 PL/1	IBM 360/168	DRIFT BCTTLE FLCTS
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80 FCRTRAN IV	IBM 360/195	ASTRENEFICAL TIGE PREDICTION
80 FORTRAN 6C	IBM 260/155	TIDES IN THE CPEN SEA
123 FORTRAN	18M 360/155	MICREFILM PLETS OF VHPR SATELLITE DATA
82 FERTRAN IV	IBM 360/195	EAST CCAST STORM SURGE
82 FORTRAN IV	IBM 360/195	NAVE FORECASTS
28 FOFTRAN IV	18M 370	ESTUARINE CHEFISTRY MYACHEM
28 FORTRAN IV	IBM 370	ESTUAPINE TILES
73 ANS FORTRAI		ECCLEGICAL STATISTICAL PROGRAMS ECESTAT
116 FCRTRAN	IB# 370	DENEREGRAPH
136 FORTRAN IV		
	IBM 370	PRCBABILITY CISTRIBUTION WEIBUL
56 FORTRAN IV	18M 370	RESOURCES ALLCCATILN IN FISHERIES MGT PISCES
50 FCFTRAN IV	IBM 370	WATER RESCURCES TEACHING GAPE DAM

55	FCRTRAN		18M 37C	CHLORCPHYLL CHLOR
55	FORTRAN		IBM 370	PHYTCPLANKTCN PCPULATION DENSITY
55	FORTRAN		IBM 370	SPECIES DIVERSITY
153	FORTRAN		IBM 370	REFORMATTED STATION OUTPUT IBM 1
	FORTRAN		IBM 370	OPTIMAL ECCSYSTEM POLICIES CEP
	FORTRAN		IBM 370/155	
	FORTRAN		IBM 370/155	ESTUARINE DENSITY CURRENTS AND SALINITY
	FORTRAN		18M 370/165	ESTUARINE MCCEL KCNLNRA
	PL/1		IBM 370/168	NONTE CARLC SPILL TRACKER
	PL/1		IBM 370/180	MARKEVIAN ANALYSIS OF TOF-14 WIND DATA
	FORTRAN	TV	IBM 1130	PLETS HYDRC CAST CATA PLOG
	FORTRAN		IBM 1130	PLOTS STD CATA STPC1
	FORTRAN		IEM 1130	REDUCTION AND CISPLAY OF DATA ACQUIRED AT SEA
	FORTRAN		IBM 1130	ANALYSIS OF NON-LINEAR RESPONSE SURFACE
	FORTRAN		IBM 1130	PULTIPLE CISCRIFINANT ANALYSIS MULDA
	FORTRAN		18# 1130	THERMCMETEF LCRRECTION TCHK2
	FORTRAN		18M 1130	BEACH SINULATION NUDEL
	FORTRAN	-	IBM 1130	BEACH AND NEARSHORE MAPS A-S
	FORTRAN		IBM 1130	PLCTS TEMPERATURE-SALINITY PSAL 1
	FORTRAN		IBM 1130	SEDIMENT CRAIN SIZE ANALYSIS
	FORTRAN	-	IBM 1130	VIELC PER RECRUIT RYLC BICH
	FORTRAN		IBM 1130	REDUCTION DISPLAY STORAGE GEOPHYSICAL DATA
	FCRTRAN		IBM 1130	STD CCHPUTATIONS SIP02
-	FORTRAN	-	IBM 1130	HYDRC CAST CCPPUTATICNS
-	FORTRAN		IBM 1130	TRANSPORT COMPUTATIONS FROM ATMOSPHERIC PRESSURE
	FORTRAN	IV	IBM 1130	SATELLITE FISE AND SET TIMES ALERT ASORT
	FORTRAN		IBM 1401	TWC-CIMENSICNAL AUTGCCRRELATION
	FORTRAN		IBM 1604	WIND DRIFT AND CONCENTRATION OF SEA ICE ICEGRID
	FORTRAN	1	IBM 1620	TRANSFORT COMPUTATIONS FROM ATMOSPHERIC PRESSURE
	FORTRAN		18M 1620	INTERPOLATION FOR LOCANOGRAPHIC DATA
	SPS		IBM 1620	COMPUTES GECGRAPHIC POSITIONS
	SPS		IBM 1620	LORAN C VERSICN2
79	FORTRAN	11	18 4 16 20	PRECESSES CLARENT INSTRUMENT OBSERVATIONS
- 48	FORTRAN	[]	IBM 1620	SOIL AND SECIMENT ENGINEERING TEST DATA
	FCRTRAN		IBM 1800	FOPPAT FREE INPUT SUBROUTINE QREAD
	FORTRAN		IBM 1800	METERS VS FATHOMS MATBL
	FORTRAN		IBM 1800	GENERATES AREITRARY FILTER HILDW
	FORTRAN		IBM 1800	SHIPBERNE HAVE RECERDER ANALYSIS SBWRD
	FCRTRAN		IBM 1800	LCRAN/DECCA CEOPDINATES CALCULATION HNAV
104	FORTRAN	1 V	IBM 1800 🕚	LORAN/DECCA FILE INITIALIZATION HNVI
104	FORTRAN	I۷	IBM 1800	GECCETIC DISTANCE AND AZIMUTH SDANG
	FORTRAN		18M 1800	CABLE CONFIGURATION
	FORTRAN		IBM 1800	DATE CALCULATIONS DAYWE
- 144	FORTRAN		18 4 1800	DATE CALCULATIONS NUDAT
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41 FORTRAN IV IBM 360/65 MARINE GECPHYSICAL CATA REDUCTION 41 FORTRAN IV IBM 360/65 PLCTS PROFILES OF DATHYMETRY AND MAGNETIC

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120	FORTRAN	TW	IBM 360/65	FITS POLYNCPIAL PSTERP
142	FORTRAN	IV	IBM 360/65	CHECKS ANGLES THOPI
142	FORTRAN	I۷	CDC 6699	CHECKS ANGLES THOP!
122	FCRTRAN	17	IEM 360/65	PLCTS SCATTERGRAM SCTGM4 SCTGMS
123	FORTRAN	I۷	CDC 6600	X-Y PLOTS EBTPLT
148	FÜRTRAN	IV	CDC 6600	REPRCCUCE AND SERIALIZE DECK DUPE
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144	FORTRAN	I۷	18M 360/65	JULIAN CAY CONVERSION JOAYWK
144	FORTRAN	IV	IBM 360/65	JULIAN CATE CONVERSION ROUTINES JULDAY
144	FORTRAN	IV	IBM 360/65	JULIAN CATE CONVERSION ROUTINES JULIAN
144	FORTRAN	IV	IBM 360/65	JULIAN CATE 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	I۷	IBM 360/65	DAY OF THE WEEK NOAYWK
17	FORTRAN	IV	CDC 65C0	WET BULB TEMPERATURE WETBLA

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51 FORTRAN IV IBM 360 TOXICI

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87 FCRTRAN	CDC 6400	PYRANCHETER AND RALICPETER TIME SERIES RAD
78 FORTRAN IV	CDC 6400	VECTOR TIME SERIES CURPLT6

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17	FORTRAN	CDC 6600	INTERNAL HAVE OSCILLATIONS ZHODE
17	FORTHAN	CDC 7600	INTERNAL WAVE CSCILLATIONS ZMODE
42	FORTRAN IV	UNIVAC 1108	LISTS RAW DATA 2LIST
42	FCRTRAN IV	UNIVAC 1108	PLCTS TRACKLINE UCKCRAN
42	FORTRAN IV	UNIVAC 1108	PLCTS CENTOUR CROSSING INTERVALS COURLX
42	FORTRAN IV	UNIVAC 1108	PLOTS GEOPHYSICAL DATA PLOT2
43	FCRTRAN IV	UNIVAC 1108	LISTS EVERY FUNCRECTH VALUE SNOCP
43	FORTRAN IV	UNIVAC 1108	NAVIGATION COPPUTATIONS TENAV
43	FORTRAN IV	UNIVAC 1108	EDITS GEOPHYSICAL LATA ZEDIT
43	FORTRAN IV	UNIVAC 1108	GECFHYSICAL CATA CLAVERSICA HANDY
44	FORTRAN IV	UNIVAG 1108	LISTS GEOPHYSICAL LATA LISTP
- 44	FCRTRAN IV	UNIVAC 1108	COURSE, SPEEC, ECTYCS CORRECTION LOXNAV
44	FORTRAN IV	UNIVAC 1106	CONVERTS GEOPHYSICAL DATA PHONEY
- 44	FORTRAN IV	UNIVAC 1108	SOUND VELOCITY VARIATION AND NAVIGATION FATHOM
45	FORTRAN IV	UNIVAC 1108	REGIENAL FIELC RESIGUAL MAGNETIC ANCHALY GAPHA
45	FCRTRAN IV	UNIVAC 1108	GRAVITY GAL
45	FORTRAN IV	UNIVAC 1108	PLCTS PROFILES OF GEOPHYSICAL DATA DISPLOT
	FORTRAN IV		CONVERTS DIGITIZER CATA DYGYT
40	FORTRAN IV	UNIVAC 1108	EDITS REDUCEC GEUPHYSICAL DATA EDIT

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38 FORTRAN IV IBM 1130 SEDIMENT GRAIN SIZE ANALYSIS

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40 FERTRAN IV IBP 1130 RECUCTION DISPLAY STOPAGE GEOPHYSICAL DATA

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64	FORTRAN	B 67CC	ESTIMATION OF LINEAR GROWTH
61	FORTRAN	B 6700	FISHING PENER ESTIMATION TOPDI

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4.9	FERTRAN	•	6700	SURVIVAL RATE ESTIMATION TOPEL
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	FORTRAN	-	6700	COCLEY-LONNES FULTIPLE-REGRESSIGN
	FGRTRAN	-	6700	BICPETRY-GCCCNESS LF FIT
	FORTRAN	-	6700	BICPETRY-EASIC STATISTIC FOR UNGROUPED CATA
	FORTRAN		6700	BICPETRY-BASIC STATISTIC FOR GROUPED DATA
	FCRTRAN		6700	BIGHETRY-SINGLE CLASSIFICATION ANOVA
		-		
	FORTRAN		6700	BICHETRY-FACTORIAL ANOVA TOSD2
	FORTRAN	-	6700	EIGPETRY-SUM CF SQUARES STP TCSD3
	FORTRAN	_	6700	BICPETRY-STUCENT-NEWHAN-KEULS TEST TCSD4
	FCRTRAN	_	6700	BICHETRY-TEST GF HLPOGENEITY
	FCRTRAN	-	6700	BICHETRY-TEST OF EQUALITY
	FGRTRAN	_	67C0	EICHETRY-TUKEY'S TEST
- 70	FORTRAN	8	6700	BICMETRY-KRUSKAL-WALLIS TEST TCSE4
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117 FOFTRAN	CDC CYBER	X-Y FLCTS IN A FLEXIBLE FCRPAT MEDSPLCT
4 FCRTRAN IV	CCC CYBER 74	DAILY SEAWATER COSERVATIONS
4 FORTRAN	CDC 6400	DATA FGT SYS FOR PHYS CHEM DATA CCEANSV
4 COBCL	IEM 360/E5	DATA PGT SYS FOR PHYS CHEN CATA CCEANSV
4 PL/1	IBM 360/85	DATA PGT SYS FCR PHYS CHEM GATA CCEANSV

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72	PL/1	18*	370/168	HURTE CARLE SPILL IFACKER
135	FORTRAN	IV 18#	360/40	SPECTRA PROGRAMS CETRND AUTOOV CRSCOV FOURTR
85	FGRTRAN	18	360/40	WATER WAVE TEACHING AIDS PROFI
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85	FCRTRAN	18	360/40	HATER HAVE TEACHING AIDS LENGE
85	FORTRAN	IB	1 360/40	WATER WAVE TEACHING AIRS DETRND
85	FORTRAN	IB!	1 360/40	NATER WAVE TEACHING AIDS WTPAX2

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85	FORTRAN	IBM :	360/40	WATER WAVE TEACHING AIDS UDFT1
85	FCRTRAN	184	360/40	WATER WAVE TEACHING AIDS WEFTL
85	FORTRAN	IBM	360/40	WATER WAVE TEACHING AIDS UTCFT1
85	FORTRAN	IBM	360/40	WATER WAVE TEACHING AIDS WTCFT1
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86	FORTRAN	IBM	360/40	WATER NAVE TEACHING AIDS PROFILE
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85	FORTRAN	IBM	360/40	WATER WAVE TEACHING AIDS EDSIT
25	FCRTRAN I	V 18M	360765	MIT SALINITY INTRUSICN PREGRAM
87	P'./1	IBM .	370/180	MARKEVIAN ANALYSIS GF TOF-14 WIND DATA
40	FORTRAN I	V 18M	7074	COMPUTATION AND PLUTTING OF MAGNETIC ANDMALIES
- 74	PL/1	IBM	360/168	CRIFT BCTTLE/STATISTICS
- 74	PL/1	IBM	360/168	DRIFT BETTLE PLETS
- 74	PL/1	IBM	360/166	REFORMAT AND SORT LRIFT BOTTLE DATA

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123 FCRTRAN CCC 66CU DISPLAYS VHRR SATELLITE DATA V5DPD 123 Fortran IBM 360/195 Microfilm Plcts of VHRR satellite data

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145	FORTRAN	I۷	IBM 1800	CURPENT METER CATA RECULTION
37	FCRTRAN	11	IBM 1800	CABLE CONFIGURATION
134	FORTRAN	17	I8M 1800	GENERATES ARRITRARY FILTER HILDW
134	FORTKAN		J6M 18CO	CLUSTER ANALYSIS
- 84	FCRTRAN	I۷	IBM 1890	SHIPBERNE WAVE RECLRDER ANALYSIS SBWRG
103	FCRTRAN		IBM 1800	SATELLITE NAVIGATION
104	FCRTRAN	I۷	IBM 1800	LCRAN/DECCA CCORDINATES CALCULATION HNAV
104	FORTRAN	IV .	18≓ 1800	LCPAN/DECCA FILE INITIALIZATION HNVI
104	FCRTRAN	I۷	IC# 18C0	GECCETIC CISTANCE AND AZIMUTH SDAND

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123	FORTHAN 63	CDC 3800	VERTICALLY ANALYZED CONTOURS VACCTS
12	FCRTKAN IV	B 67C0	PLCT TEMP LIST FIXED LAYER DEPTH WEEKPLCT
12	ALGOL	E 67CC	CONSTANTS FOR PARPLAIC SYNTHESIS MEAN SEA TEMP
12	FORTRAN 63	CDC 3600	VERTICAL SECTION PLOTS ESTPAC
13	FCRTRAN	CCC 3000	CONVERTS STO CATA REECTP
13	FORTRAN	CDC 3600	CORRECTS STO DATA IPHCD
- 56	FCRTKAN	B 6700	LENGTH FRECUENCY ANALYSIS LENFRE
- 56	FORTRAN	8 6700	YIELD PER RECRUIT FOR MULTI-GEAR FISHERIES
57	FORTRAN	B 670C	A GENERALIZED EXPLCITED POPULATION SIMULATOR
57	FCRTRAN	CDC 6600	A GENERALIZEC EXPLLITEC POPULATION SIMULATOR
- 57	FORTRAN	CDC 6600	GENERALIZEC STCCK PRCDUCTION MODEL PRODFIT
- 57	FORTRAN	B 6700	GENERALIZED STOCK PROCLETION MODEL PROOFIT
87	FORTRAN	B 67CQ	SUPPARIZES WEATHER REPORTS

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124 FORTRAN IV IBM 360/65 CXYGEN FMCSFFATE CENSITY PLCTS 124 FORTRAN IV IBM 360/65 GENERAL MERCATOR PLGT

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112 FERTRAN IV	IBM 360/30	ADJUSTS A STATE PLANE COORDINATE TRAVERSE
113 FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBACUTINE SYSTEM ANGLE
113 FOPTRAN IV	IBM 360/65	NGS SCIENTIFIC SUBROUTINE SYSTEM ANLIS
113 FORTRAN IV	18M 360/65	NGS SCIENTIFIC SUBACUTINE SYSTEM APCTN
	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APCHN
	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APOLY
	18M 260/65	NOS SCIENTIFIC SUBRCUTINE SYSTEM CGSPC
	184 360/65	NGS SCIENTIFIC SUBRCUTINE SYSTEM CUBIC
113 FORTRAN IV	IBM 360/65	NGS SCIENTIFIC SUBROUTINE SYSTEM EXCEB
113 FORTRAN IV		NOS SCIENTIFIC SUBACUTINE SYSTEM GALIC
113 FORTRAN IV	IBM 36C/45	NOS SCIENTIFIC SUBRCUTINE SYSTEM HIFIX
114 FCRTRAN IV	IBM 360/65	NCS SCIENTIFIC SUBKCUTINE SYSTEM LORAN
	IBM 360/65	NOS SCIENTIFIC SUBRCUTINE SYSTEM OMEGA
	IBX 300/05	NCS SCIENTIFIC SUBACUTINE SYSTEM SCOIN
114 FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBACUTINE SYSTEM SCCPN
114 FORTRAN IV	IBM 360765	NGS SCIENTIFIC SUBROUTINE SYSTEM TPFIX
114 FORTRAN IV	18M 360/65	NCS SCIENTIFIC SUBACUTINE SYSTEM UTHCO
114 SPS	18M 1620	COMPUTES GECGRAPHIL POSITIONS
114 SPS	IBM 1020	LORAN C VERSIEN2
80 FORTRAN IV	CDC 6600	HARMONIC ANALYSIS OF CATA AT TIDAL FREGUENCIES

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82 FORTRAN IV	CDC 6600	HURRICANE STORP SUNGE FORECASTS SPLASH I
82 FORTRAN IV	CDC 6600	HURRICANE STCKM SUNGE FORECASTS SPLASH II
82 FORTRAN IV	IBM 360/195	EAST CLAST STORM SURGE
82 FCRTRAN IV	[8M 360/195	HAVE FORECASTS
80 FORTRAN IV	[B# 360/195	ASTRONCHICAL TICE PREDICTION

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30 F	GRTRAN	17	CDC 6600	DEEP CCEAN LCAC HANCLING SYSTEMS COLLS
- 30 F	ORTRAN	IV	CDC 6600	LCAC MCTICN AND CABLE STRESSES CABL
30 F	ORTPAN	I۷	CDC 66CO	SOIL TEST CATA TRIAX
30 F	CRTRAN	LV -	0066 303	OYNAMIC STRESS RESPONSE OF LIFTING LINES CABANA
- 31 F	FORTEAN	11	CDC 6600	DYNAMIC RESPONSE OF CAELE SYSTEM SNAPLG
		-	CDC 6600	CHANGES IN ELECTROMECHANICAL CABLE RAMSC
		-	CDC 6600	END RESPONSES IN ELECTROMECHANICAL CABLE RACAC
48 F	FORTRAN	11	IBM 1620	SOIL AND SECIMENT ENGINEERING TEST DATA

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17	FORTRAN LV	IBM 360	CRJECTIVE THERPCCLINE ANALYSIS
17	FORTRAN IV	CDC 6500	COJECTIVE THERPELINE ANALYSIS
91	FURTRAN 60	IBM 1604	WINC ERIFT AND CONCENTRATION OF SEA ICE ICEGRID
97	FORTRAN	CDC 3100	SCUND SPEED CCPPUTATION MODEL SOVEL
97	FCRTRAN	CCC 3200	SCUND SPEED COMPUTATION MODEL SOVEL
97	FORTRAN	CCC 1604	SCUND SPEEC COMPUTATION MODEL SOVEL
93	FCRTRAN IV	CDC 1604	SCUNC SCATTERING BY CREANISHS SKAT
72	FORTRAN IV	CDC 6500	THEFPAL POLLUTION MODEL
72	FCRTRAN IV	CEC 1604	THERP, L POLLUTION PODEL

72	FORTRAN		CDC	3100	DANISH ADVECTION PROGRAM
134	SCRTRAN	IV	IBM	360	TIME SERIES ANALYSIS BLACKY
83	FORTKAN	IV	CDC	6500	FRENCH SPECTRC-ANGULAR WAVE MODEL
83	FORTRAN	1V	CDC	7600	FRENCH SPECTRC-ANGULAR WAVE MODEL
	FCRTRAN			3100	SURF PREDICTION MOLEL
	FORTRAN	•••		3100	SINGULAR WAVE PRECICTION MODEL
	FORTRAN			3200	SINGULAR HAVE PREDICTION MODEL
	FCRTRAN			360	SPECIFIC CONCUCTIVATY WITH PRESSURE EFFECT
	FORTRAN			6500	MULTI-LAYER HYDRODYNAMIC-NUMBERICAL PODEL
	FCRTRAN			7600	PULTI-LAYER HYCRODYNAFICAL-NUMERICAL MOCEL
- 24	FORTRAN	11	CCC	6500	SINGLE LARGE HYDRCLYNAMICAL-NUMERICAL MCDEL
24	FORTRAN	I۷	IBM	360	SINGLE LARGE HYDRGUYNAMICAL-NUMERICAL MCDEL
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	FORTRAN			3100	ATMCSPHEPIC NATER CONTENT MODEL
	FORTRAN			6500	CCEAN-ATMCSPHERE FLEDBACK MODEL
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-	FORTRAN			1604	WIND COMPUTATION FACH SHIP OBSERVATIONS TRUMIND
- 75	FORTRAN			7600	CPTIMIZED FULTI-LAYER HN MODEL
- 75	FGRTRAN		CDC	3100	CPTIMIZED HULTI-LAYER HN MGDEL
75	FORTRAN		CDC	6500	FEAN CRIFT ROUTINE
75	FGRTRAN		CDC	1604	MEAN CRIFT REUTINE
	FORTRAN				TIDES IN THE CPEN SEA
				4/2	

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148 FORTRAN II	CDC 1604	FORTRAN ACCESS TO SCIENTIFIC DATA FASD
76 FORTRAN	CDC 6500	SEARCH AND RESCUE PLANNING NSAR

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	14 F	CRTRAN	EXT	CDC	6500	GCEANEGRAPHIC DATA COMPUTATION TPOONV
	15 F	ORTRAN	EXT	232	6500	VARIANCE AND STANDARD DEVIATION SUMMARY

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120 FORTRAN IBM 360/65 SEQUENTIAL FLOTTING

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138	FCRTRAN	V	UNIVAC	1108	CURVE FITTING VELOUITY PROFILE NEWFIT
101	FORTRAN	IV	UNIVAC	1108	SCNAR IN REFRACTIVE WATER
101	FCRTRAN	IV.	UNTVAC	1108	SCNAR IN REFRACTIVE WATER
101	FORTRAN	11	UNIVAC	1108	SCRTS SCUNC RAY DATA RAY SORT
45	FCRTRAN	Ľ٧	UNIVAC	1108	PATTERN FUNCTION CALCULATIONS
45	FORTRAN	¥	UNIVAC	1109	RAYLEIGH-MCRSE BOTICM REFLECTION COEFFICIENTS

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94	FORTRAN V	UNIVAC 11	CB BEAM PATTERNS AND NIDTHS GBEAM
- 54	FORTRAN V	UNIVAC 11	OB STATISTICS ACCUSTIL MEASUREMENTS AND PREDICTIONS

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94 FORTRAN IV UNIVAC 1108 PROPAGATION LOSS FAST FIELD PROGRAM 94 FORTRAN II UNIVAC 1108 BOTTOM REFLECTIVITY 45 FORTRAN V UNIVAC 1108 PROPAGATION LESS 45 FORTRAN V UNIVAC 1108 AMOS FREPAGATION LESS 36 FORTRAN V UNIVAC 1108 TONED SYSTEP CYNAMICS UNIVAC 1108 UNIVAC 1108 UNIVAC 1108 UNIVAC 1108 36 FORTRAN V TRAPEZCIDAL ARRAY DEPLOYMENT DYNAMICS 37 FORTRAN V STEADY STATE CARLE LAYING TOWEC ARRAY CONFIGURATIONS 37 FORTRAN V UNIVAC 1108 UNIVAC 1108 37 FCRTRAN V TRAPEZCIDAL ARRAY DYNAMICS 125 FORTRAN SPECTRAL ANALYSIS SUBROUTINES 47 FORTRAN UNIVAC 1108 TRUE CCEAN CEPTH FATHCR UNIVAC 1108 UNIVAC 1108 53 FORTRAN IV GENERATES ZCCPLANKICN TAXONOMIC DIRECTORY DEEP CCEAN ZCOPLANKTON DISTRIBUTION 53 FORTRAN IV 53 FORTRAN IV UNIVAC 1108 DEEP CCEAN 2CCPLANKTCN POPULATION STATISTICS CURRENT PROFILES FROM TILT CATA 74 UNIVAC 1108 UNIVAC 1108 16 FORTRAN V STO-S/V DATA 52049 STEADY STATE TRAPEZOIDAL ARRAY CUNFIGURATIONS 32 FOUTRAN V 32 FORTRAN V UNIVAC 1108 ANCHOR LAST-RUCY SYSTEM DEVELOPMENT CYNAMICS **33 FCRTRAN V** UNIVAC 1108 CABLE TEWED BLEY CUNFIGURATIONS IN A TUPN FREE-FLCATING SPAR-ARRAY CYNAMICS FREE-FLCATING SPAR-EUCY DYNAMICS SHIP SUSPENCEC ARRAY CYNAMICS 33 FORTRAN V UNIVAC 1108 UNIVAC 11C8 UNIVAC 1105 33 FORTRAN V 33 FCRTRAN V BCCMERANG CORER DESCENT/ASCENT TRAJECTERIES BUDY-SHIP DYNAMICS 34 FORTRAN V UNIVAC 1108 UNIVAC 1108 34 FORTRAN V 34 FCRTRAN V UNIVAC 1108 BUCY-SYSTEP EYNAMILS UNIVAC 1108 UNIVAC 1108 FIXED THIN LINE ARKAY CYNAMICS FIXED THIN LINE ARKAY STEADY STATE CONFIGURATION 34 FORTRAN V 35 FORTRAN V UNIVAC 1108 UNIVAC 1106 35 FORTRAN V MAR'NE CORER CYNAMICS STEADY- TATE BUCY SYSTEM CONFIGURATIONS 35 FORTRAN V 30 FORTRAN V STEAUY-STATE SUBSURFACE BUCY SYSTM CONFIGURATION UNIVAC 1108 36 FORTRAN V UNIVAC 1108 TONED ARRAY CYNAMILS

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142	FORTRAN	CCC 3300	SOLVE ALGEBRAIC EQUATIONS MATRIX
121	FORTRAN	CDC 3300	PHYSICAL CATA PLOT FRAME
- 99	FORTRAN	COC 3360	ACCUSTIC FERFERMANCE AND EVALUATION
- 94	FCRTRAN	CDC 3300	SCUND REFRACTION CURRECTIONS FITIT
15	FORTRAN		SIGMA-T INVREJ
15	FORTRAN		STD PROCESSING OCEANDATA
15	FORTRAN		INTERNAL WAVES WITCOMB
15	FCRTRAN	CDC 3200	INTERPOLATION FOR LOCANOGRAPHIC DATA
15	FORTRAN	IBM 1620	INTERPOLATION FOR LOEANOGRAPHIC DATA
75	FORTRAN	CDC 3300	
75	FORTRAN	CDC 3300	CURRENT METER DATA CURRENT
75	FGRTRAN	CDC 3300	CURRENT HETEF CATA CURRPLOT
75	FORTRAN	CDC 3300	CURPENT METER CATA SPECTRUM

NAVY, LAVAL SURFACE WEAPONS CENTER, SILVER SPRING, PD

93 FORTRAN IV	CDC 6500	NOFFAL MUCE CALCULATIONS NOFMED 3
93 FORTRAN	COC 6400	HORIZENTAL RANGE

NAVY, NAVAL RESEARCH LABCRATCRY, WASHINGTON, CC

120 FCRTRAN CCC 3800 LINE PRINTER FLCTS

124	ASSEMBLY	HP 21005	PLETTER CEMPANES PLET EVRIC
	FORTRAN 63	SDC 3800	GRASS UNDERNATEP ALCUSTICS PREDICTION DISTOV
	FCRTRAN 63	CCC 3800	GRASS UNDERWATER ALCUSTICS PREDICTION VFC
	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACCUSTICS PREDICTION CTOUR
	FORTRAN 63	CDC 3000	GPASS UNDERWATER ACCUSTICS PREDICTION PREPLT
	FORTRAN 63	CDC 1800	GRASS UNDERWATER ACCUSTICS PREDICTION SERPENT
	FCRTRAN 63	CDC 3800	GRASS UNDERWATER ALCUSTICS PREDICTION PAFLET
	FORTRAN 63	CDC 3800	GRASS UNDERNATER ACCUSTICS PREDICTION LOSSPLOT
	FCRTRAN IV	HP 21005	THERMCHETRIC CEPTH CALCULATION CAST
	FORTRAN IV	HP 210US	THERNCHETER CATA FILE HANDLER THERNO
	FERTRAN	CCC 3300	INTERNAL GRAVITY WAVES DISPER
	FORTRAN IV	CDC 3200	SEA SURFACE TEFFERATURES ANALYSIS
	PASIC	HP 9830A	UNMANNED FREE-SHIMMING SUBPERSIBLE PLCT
32	BASIC	HP 9830A	UNMANNED FREE-SWIMMING SUBMERSIBLE HOTEL LCAD
32	EASIC	HP 9830A	UNMANNEC FREE-SWIMMING SUBFERSIBLE
107	FORTRAN	COC 3800	ANNCTATED TRACK UN STEREOGRAPHIC PREJECTION
107	FCRTRAN IV	HP 21005	ANNOTES CHART
108	FORTRAN IV	HP 21005	BATHYPETRIC CR PAGNETICS CHART PROFL
138	FORTRAN IV	HP 21005	MERCATOR CHAFT CIGITIZATION ANTRK
108	FORTRAN IV	HP 2100S	BATHYPETRIC CHART LIGITIZATION DEBTH
108	FCRTRAN IV	HP 21005	PLCTS ON STEFECGRAPHIC CHART ANNOT
108	FORTRAN IV	HP 21005	PLCTS NAVIGATION CATA GCEAN
109	FORTRAN IV	HP 21005	LONG BASE LINE ACCUSTIC TRACKING
89	FCRTRAN	CCC 3800	MIE SCATTERING COMPUTATIONS
. 47	FCRTRAN	CDC 3600	PLCTS TRACK AND DATA PROFILE TRACK
47	FORTRAN	CDC 3800	PLCTS TRACK AND DATA PROFILE TRACK
	FORTRAN	CDC 3800	GECDATA
	FORTRAN	CDC 36C0	GEODATA
	FCRTRAN	CDC 3600	MAGNETIC SIGNATURES MAGPLET
	FCRTRAN	CDC 3800	MAGNETIC SIGNATURES MAGPLOT
107	FORTRAN	CDC 3600	ALNCTATED TRACK ON STEREOGRAPHIC PROJECTION

NAVY, FLEET WEATHER FACILITY, SUITLANC, MD

91 FURTRAN II CUC 160A ICE DRIFT ANALYSIS/FORECAST

NAVY, NAVAL OCEANCGRAPHIC OFFICE, WASHINGTON, CC

139	FURTRAN	IBM 7C74	LEAST SCUARES PLOT
139	FORTRAN	UNIVAC 1108	TEMPERATURE SALINITY CORRECTIONS CURVEFIT NISSI2
139	FORTRAN	PDP-9	BARTLETT'S CLRVE FITTING
121	FURTRAN V	UNIVAC 1108	REFORMATS DATA PLOTS TRACK CHART MASTRACK
	FCRTRAN		PRODUCES CONTOUR CHARTS GRIDIT
121	FORTRAN		PRODUCES CONTOUR CHARTS AUTONATED CONTOUR
100	FORTRAN	18M 7074	CRITICAL ACCUSTIC HATIC
	FORTRAN	UNIVAC 1108	SCUNC VELCCITY FOR MARINE SEDIMENTS
\$8	FORTRAN	IEM 7074	LIGHT AND SELND INSTRUCTION B
45	FCRTRAN	IBM 7C74	LIGHT AND SCUNE INSTRUCTION D
144	FCRTRAN	IBM 7074	BATHYPETRIC CATA RECUCTION
14	FERTRAN	IBM 7074	MONTHLY SONIC LAYER DEPTH
14	FERTRAN	IBM 7074	VERTICAL TEMPERATURE GRADIENTS
14	FORTRAN V	UNIVAC 11C8	WATER CLARITY
137	FORTRAN	18M 7074	SINGLE INTEGRATION
	FORTRAN 11	187 7074	INDIVIDUAL FEINT GENERATCH FER MAP PROJECTIONS
111	FORTRAN II	187 7074	INCIVIDUAL POINT GENERATOR FOR DISTANCE
111	FCRTRAN	187 7074	GECDETIC CATUM RECUCTION
111	FORTRAN	187 7074	GEODETIC POSITION COMPUTATION AND PLOT

111 FORTRAN ASTRCNOPIC LATITUDE 112 FORTRAN COC 3100 SOUNDING PLCT 112 FORTRAN **IBM 7074** SOUNDING PLCT SINGLE INTEGRATION SODANC INVERSE 112 FCRTRAN IBM 7074 112 FORTRAN CDC 3100 89 FORTRAN 18M 7074 SOLAR RADIATION CONVERSION 89 FORTRAN IBM 7074 WINC STRESS 89 FCRTRAN TWC-DIMENSIONAL POWER SPECTRUM FOR SWOP II **IBM 7074** 90 FCRTRAN IBM 7074 PRED'CTION OF VERTICAL TEMPERATURE CHANGE CLCUD COVER AND DAILY SEA TEMPERATURE 90 FCRTRAN IBM 7074 46 FORTRAN IBM 7074 SEAMCUNT MAGNETIZATION 46 FORTRAN CBSERVATICN CRAPING GRAVITY IBM 7074 UNIVAC 1108 UNIVAC 1108 48 FORTRAN SEDIMENT SIZE 48 FORTRAN IV BOTTCH SEDIMENT DISTRIBUTION PLOT CURRENT METER TURBULENCE 76 FORTRAN 18M 7074 UNIVAC 1108 UNIVAC 1108 UNIVAC 1108 76 FORTRAN V IN-SITU CURPENT 76 FORTRAN WATER DISPLACEMENT DISPLA 77 FORTRAN V CURRENT METER PRINT UNIVAC 1108 UNIVAC 1108 77 FORTRAN V CURRENT METER PLOT 77 FORTRAN V CONVERT CURRENT METER TAPE 77 FORTRAN V UNIVAC 1108 CURRENT METER DATA PPRINTO

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NAVY, DEFENSE MAPPING AGENCY HYDROGRAPHIC CENTER. #ASHINGTON. DC

109	FORTRAN	UNIVAC 1108	FAA FLCT
109	FCRTRAN	UNIVAC 1108	DISTANCE AND AZIMUTH CIRAZD
109	FORTRAN	UNIVAC 1108	PARAMETRIC MAP
110	FORTRAN	UNIVAC 1108	LORAN TO GEOGRAPHIC AND/GEOGRAPHIC TO LORAN
	FGRTRAN	UNIVAC 1108	LORAN CCORCINATE CLHPUTATIGN
110	FORTRAN	UNIVAC 1108	LORAN SKYHAVE CORRECTION

NAVY, NAVAL ACADEFY, ANNAPOLIS, HD

13 BASIC	IBM 360	ENVIRONMENTAL CYNAMICS SUBROUTINES OCEANLIB
13 EASIC	IBM 360	GEOSTROPHIC CURRENI

NORTH CARCLINA STATE UNIVERSITY, RALEIGH, NC

84 FORTRAN	IBM 360/165	WAVE INTERACTION WITH CURRENT CAPGRAY
24 FORTRAN	IBM 370/165	ESTUARINE MCCEL NONLNRA
26 FCRTRAN	CCC 6400	UPWELLING CSTLUPHL
26 FORTRAN IV		MATHEPATICAL WATER GUALITY MODEL FOR ESTUARIES
26 FORTRAN IV		COMFUTATION OF FLGM THROUGH MASONBORD INLET NO
26 FORTRAN IV	IBM 360	CIRCULATION IN PAMLICO SOUND

CREGON STATE UNIVERSITY, CORVALLIS, CR

126	FORTRAN	CDC	3300/GS3	TIME	SERIES	ARAND	ACFFT
12¢	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	ACCRR
126	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	ACRPLT
126	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	ALIGN
126	FORTRAN	CDC	3300/CS3	TIME	SEPIES	ARANC	AFPACO
126	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	ARMAP
	FERTRAN	CDC	3300/053	TIME	SEALES	APAND	AUTC
126	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	AUTCPLT

126	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	AXISL
126	FORTRAN	CDC	3300/053	TIME			
127	FURTRAN	CDC			SERIES	ARAND	LCFFT
			3300/053	TIME	SERIES	ARAND	CCORR
127	FCRTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	CCNPLT
127	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARANU	LCMPLOT
127	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	CONFID
127	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	CENFID 1
127	FORTRAN	CDC	3300/CS3	TIME	CERIES	ARAND	· •
127	FORTRAN	CDC	3300/053				CCNMODE
127	FORTRAN	CDC		TIME	SERIES	ARAND	ССРН
127		-	3300/CS3	TIME	SERIES	ARANC	CCSTR
	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	CPEES
127	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	CPLT1
127	FORTRAL	CDC	3300/CS3	TIME	SERIES	ARAND	CPLT2
127	FORTRAN	CDC	3300/GS3	TIME	SERIES	ARAND	CROPLT
127	FORTRAN	COC	3300/053	TIPE	SECIES	ARAND	CROSS
127	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	
127	FCRTRAN	ČCC					CUSID
128	FORTRAN		3300/053	TIME	SERIES	ARAND	CUSFC
		CDC	3300/053	TIME	SERIES	ARAND	CZT
128	FORTRAN	CDC	3300/653	TIME	SERIES	ARAND	DATPLT
128	FCRTRAN	CDC	33007CS3	TI₽E	SERIES	ARAND	DEMODI
128	FCRTRAN	CDC	3300/053	TIME	SERIES	ARAND	LEMCD2
128	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	DEMC03
128	FORTRAN	CDC	3300/053	TIME	SERIES	APAND	CETRND
128	FORTRAN	COC	3300/053	TIME	SERIES	ARANG	GIFF12
128	FCRTRAN	CDC	3300/053	Tire	JERIES	ARAND	
128	FCRTRAN	CDC	3300/CS3	TIME			LUREKA
129	FORTRAN	COC	3300/C\$3		SERIES	ARAND	EXSMG
128	FORTRAN			TIME	SERIES	ARAND	FFIN
128		CDC	3300/CS3	TIME	SERIES	ARAND	FFINI
	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	FFTCNV
128	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	FFTPS
128	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	FFTS
128	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	FFTSPC
128	FORTRAN	CDC	3300/053	TIME	SEFIES	ARAND	FILTER1
128	FORTRAN	C0C	3000/053	TIME	SERIES	FRAND	FIVET
129	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	FCLD
129	FORTRAN	COC	3300/CS3	TIME	SERIES	ARANC	
129	FCRTRAN	COC	3300/CS3	TIME	SERIES		FCURTR
129	FORTRAN	CDC	3300/053			ARAND	FOUSPC
129	FORTRAN	-		TIME	SERIES	ARAND	FCUSPC1
129	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	FCUSPC2
		CDC	3300/053	TIME	SERIES	ARAND	FRESPON
129	FORTRAN	CDC	3300/CS3	TIME	SERIES	PRAND	GAPH
129	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	GENERL
129	FORTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	GENER2
129	FORTRAN	CDC	3300/053	TIME	SERIES	ARANC	GENERS
129	FORTRAN	CDC	3300/053	TIME	SERIES	ARANU	LCGPLGT
129	FCRTRAN	000	3300/053	TIME	SERIES	ARAND	AC12T
129	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	FFAPLT
129	FORTRAN	CDC	3300/053	TIXE	SERIES		
129	FCRTRAN	CDC	3300/CS3			ARAND	PLTFCR
129	FORTRAN	-		TIME	SERIES	ARAND	PLTFRC
		CDC	3300/053	TIME	SERIES	FRAND	FLTSPC
130	FORTRAN	CDC	3200/053	TIPE	SERIES	ARAND	FCLRT
130	FORTRAN	COC	3300/053	TIME	SERIES	ARAND	FCLYDV
130	FORTRAN	000	3300/053	TIME	SERIES	ARAND	PROPLT
130	FGRTRAN	CDC	3300/CS3	TIME	SERIES	ARAND	PSQRT
130	FORTRAN	202	3300/053	TIME	SERIES	FRAND	RANCH
130	FORTRAN	CDC	3300/053	TIME	SERIES	APAND	KCTFFT
130	FORTRAN	COC	3300/053	TIME	SERIES	FRANC	RESPON
130	FORTRAN	CDC	3300/053	TIME	SERIES	ARAND	REVERS
130	FORTRAN	202	3300/053	TIME	SERIES		APLACE
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130	FORTRAN		CDC	3300/053	TIME	SERIES	APAND	RVERS		
130	FORTRAN		CDC	3300/053	TIME	SERIES	ARAND	SARIT		
130	FCRTRAN		CDC	3300/CS3	TIME	SERIES	ARAND	SERGEN		
130	FORTRAN		232	3300/053	TIME	SERIES	ARAND	SHAPE		
130	FORTRAN		CDC	3300/CS3	TIME	SERIES	ARAND	SINTR		
130	FORTRAN		CDC	3300/053	TIME	SERIES	ARAND	SHO		
130	FCRTRAN		CDC	3300/053	TIME	SERIES	ARAND	SPEC		
130	FORTRAN			3300/CS3						
130	FCRTRAN			3300/CS3						
131	FORTRAN		CDC	3300/053	TIME	SERIES	ARAND	TAUTOPLT		
	FORTRAN			3300/CS3						
	FORTRAN		CDC	3300/CS3	TIME	SERIES	ARAND	TCROPLT		
131	FORTRAN		CDC	3300/053	TIME	SERIES	ARAND	IFCRM1		
131	FORTRAN		CDC	3300/053	TIME	SERIES	ARAND	TFORM2		
	FORTRAN		CDC	3300/053	TIME	SERIES	ARANO	TIMSPC		
	FCRTRAN			3300/GS3						
131	FORTRAN		CDC	3300. 253	TIME	SERIES	FRAND	INCIZT	•.	
	FCRTRAN			3300/053						
	FORTRAN			3300/053						
	FORTRAN		CDC	3300/053	TIME	SERIES	ARAND	TPLTSPC		
	FORTRAN		202	3300/053	TIME	SERIES	ARAND	TRISPO		
	FORTRAN		CDC	33007053	TIME	SERIES	ARAND	TSGEN		
	FORTRAN			3300/083						
	FORTRAN			3300/CS3						
	FORTRAN			3300/(\$3						
	FORTRAN			3306/CS3						
	FORTRAN			3300/053						
	FORTRAR			3300/CS3						
	FURTRAM			3300/CS ن						
	FORTRAN			3300/053						
	FORTRAN			3300/GS3						
	FORTRAN			3300/053						
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	FORTRAN			3300/CS3						
	FORTRAN			3300/CS3						
	FERTRAN			370/155					AND SALINI	
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	FCATPAN								GEOPHYSICAL	
	FGFTRAN			3300					ICN AND AND	
39	FORTRAN	I.A.	CDC	3300	4 I.I.	BRARY C	F GEGP	HYSICAL SI	UBROUTINES	GLIE

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RAND CORPORATION, SANTA PONICA, CA

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91	FORTRAN	T۷	IBM	7090-94	SEA	ICE	STUCIES	YARIT
91	FORTHAN	Ľ٧	IBM	7050-94	SEA	ICE	STUCIES	FLIP
91	FORTRAN	Ľ٧	IBM	7090-94	SEA	ICE	STUCIES	SALPR
91	FORTRAN	L٩	1BM	7090-94	SEA	ICE	STUCIES	RITE

RICE UNIVERSITY, POUSTON, TX

38 FORTRAN EW CDC 6600 CONVECTION INVARIABLE VISCOSITY FLUID CONVEC

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SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA

142	FORTRAN	IBM 1800	TRIGONCHETRY SUPROLTINES ASSUB SAS ASA
116	FORTRAN LY	CDC 3600	PLCTTING PREGRAM FACEL

FCRTRAN	13M 1800	FORMAT FREE INPUT SUBROUTINE GREAD
FORTRAN	IBM 1800	METERS VS FATHENS MATBL
FERTRAN	18M 18C3	DATE CALCULATIONS LAYWE
FORTRAN	IBM 1800	DATE CALCULATIONS NODAT
FCRTRAN	IBM 1800	CATE CALCULATIONS NATEY
FORTRAN	IB# 1800	DATE CALCULATIONS YSTOY
FORTRAN	18M 1800	JULIAN CAY SLERCUTINES CIEJI
FORTRAN	IBP 1800	JULIAN LAY SLERCUTINES CLJUL
FORTRAN	IBM 18CO	TIME CONVERSION DTIME
FERTRAN 6		HYDREGRAPHIC CATA REDUCTION THE FIVE
FORTRAN I	CDC 66C0	STC CATA PRECESSING
FORTRAN	18M 1800	PLCTS MERCATCH GRIL CHART
FORTRAN	IBM 1800	NAVIGATIONAL SATELLITE PASSES ALRTX
FORTRAN	IEM 1800	LORAN FIX LRFIX
FPRTKAN	IBM 18CO	PLAN CELRSE AND SCHEDULE CRUIS
FCRTRAN	18M 1800	EARTH SPHERICAL SUBRCUTINES ESTCH ESTC2 ESTPL
FORTRAN	18M 1800	LEGREE CONVERSIONS DEGRA DEMI
FCRTRAN	IBM 1800	MEPCATOR DEGREES DARCT
FCRTRAN	IBM 1600	MAGNETIC FIELE COMPLNENTS MAGFI
FORTRAN	CDC 3600	SPECIES AFFINITIES REGROUP
FORTRAN	CDC 3000	X-Y FLCTS PLEPAK
ALGOL	B 67CO	STATICN DATA RETRIEVAL HYCROSEARCH
ALGGL	B 67C0	INTERACTIVE CALCULATIONS DSDP/CALC
ALGOL	B 6700	SELNE VELOCITY THRE SELID SAMPLES DSEP/SEN
ALGOL	B 670C	MAILING LABELS
ALGOL	B 67C0	SANC SILT AND CLAY FRACTIONS DSDP/GRAIN
	FGRTRAN FCRTRAN FCRTRAN FCRTRAN FORTRAN FORTRAN FORTRAN FORTRAN FCRTRAN FORTRAN FCRTRAN	FGRTRAN IBM 1800 FGRTRAN IBM 1800

SOLTHAPPTON COLLEGE, SOUTHAPPTON, NY

25 FORTRAN IV IBM 360/65 MIT SALINITY INTRUSION PROGRAM

TEXAS AGN UNIVERSITY, COLLEGE STATICN, TX

7 FCRTRAN IV IEM 300/65 REAC CALC INTERP STATICN DATA CAPRICCRN 7 FORTRAN IV IBM 360/65 STATICN DATA CALCULATIONS F3 8 FORTRAN IV IBM 360/65 PLCTS STATICN CATA PLTECT 8 FORTRAN IV IBM 360/65 CALCULATES STATION DATA SECPG 103 FCRTRAN IV IBM 360/65 PLCTS MAPS GPIDS THACKS MAP

UNIVERSIDAD N & CE MEXICC, MEXICC, DF

S FURTRAN IV B 6700 CCEANCGRAPHY STATILN CCMPUTER PROGRAM

UNIVERSITY OF BERGEN, NORMAY

79 FORTRAN 11 IBM 1620 PRCCESS'S CLARENT INSTRUMENT OBSERVATIONS

UNIVERSITY OF CELAWARE, LEWES, DE

25 FORTRAN IV IBM 360 CYNAMIC DETERMINISTIC SIMULATION SIMULATION

UNIVERSITY OF HANALE, HONCLLLU, HI

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116 FORTRAN	18M 360	DENDREGKAPH
116 FERTRAN	. LOM 370	CENERCGRAPH

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UNIVERSITY OF ILLINOIS, URBANA, IL

83 FORTRAN IN IBN 360/75 WAVE BETTER VELOCITY

UNIVERSITY OF MAINE, WALPCLE, ME

153	FCRTRAN		IBM	370	REFCRMATTED STATION OUTPUT IBM 1
28	FORTRAN	I۷	18M	370	ESTUARINE CHEPISTRY MYACHEN
28	FORTHAN	I۷	- IBM	370	ESTUARINE TICES
55	FORTRAN		IBM	370	CHLCRCPHYLL CHLGR
55	FORTRAN		1BM	370	PHYTOPLANKTCN POPULATICN 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 PIAPI, MIANI, FL

20	FORTRAN	PDP-11	GENERAL PURPOSE ECITOR DASEC
20	FORTRAN	PDP-11	TIME SERIES INTO PROFILES CHSCHP
20	FCRTRAN	PDP-11	AANCERAA CURRENT NETER DATA AACAL
20	FORTRAN	P0P-11	CURRENT FREFILER DATA MK2CAL
20	FORTRAN	PDP-11	APPENCS NEW CATA TO FILE DERIVE
20	FCRTAAN	UNIVAC 1106	APPENCS NEW CATA TU FILE CERIVE
20	FORTRAN	UNIVAC 1106	CONCATENATES SCRTS SEGMENTS OUTPUTS DASCRT
20	FORTPAN	UNIVAC 1106	INTERPOLATES TO UNIFORM GRID MATRIX OI
20	FCRTEAN	JNIVAC 1106	TIME SERIES STO OR POM PROFILES PLSAC
	FORTPAN	UNIVAC 11G6	INTERNAL WAVES IWEG
20	FCRTAAN	UNIVAC 1106	CYNAMICAL FIELDS INTERNAL HAVE RAYS CHRSEC
20	FORTAAN	UNIVAC 1106	AUTC AND CRESS SPELTRA TUKEY METHOD
20	FCRTPAN	UNIVAC 1106	AUTC AND CRESS SPECTRA POLARIZED FORM CHXSPC
20	FCRTRAN	UNIVAC 1106	AMPLITUCES PHASES LEAST SQUARES TIDES4
20	FERTRAN	UNIVAC 11CC	METECRCLOGICAL FLUXES PETFLX
20	FORTEAN	UNIVAC 1106	CRESS CEVARIANCE MATRIX EMPEIGI

UNIVERSITY OF MICHIGAN, ANN ARBOR, MI

104 MAC	18M 7090	GENERAL MAP FROJECTION
104 MAD	18M 7050	FINITE PAP PROJECTION DISTORTIUNS

UNIVERSITY OF PITTSBUPGH, PITTSBURGH, PA

SC MAD IBN 7090 THECRETICAL PACIAL TIDAL FORCE

UNIVERSITY OF RHODE ISALND, KINGSTON, RI

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28 FORTRAN IBM 370/155 MODELING AN ECEAN POND

UNIVERSITY OF PUERTO RICO, MAYAGUEZ, PR

5 FORTRAN LI POP 8E	MASS TRANSPORT AND VELOCITIES GEOMASS
5 FORTRAN IV POP 10	STATICN DATA THIRP
5 FORTPAN IV PDP 10	THERMEMETER CORRECTION THERMOMETRIC DEPTH

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147 FORTRAN IV IBP 360/65	READS NCCC STATION DATA TAPE
51 FORTRAN IV CDC 6600	PRODUCTIVITY CXYGEN
52 FORTRAN IV COC 6600	SPECIES DIVERSITY JOB
52 FORTRAN IV CDC 6600	PREDUCTIVITY ECCPRED

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146 FORTRAN II IBM 7094	STATICN DATA REDUCTION SYNOP
27 FERTRAN IV CDC 6400	THREE-DIMENSIONAL SIMULATION PACKAGE AUGUR
52 FORTRAN IV IBM 7C94	CONCENTRATIONS PER SQUARE METER OF SURFACE
52 FORTRAN IV CDC 6400	COMBINED CHLCRCPHYLL AND PRODUCTIVITY
53 FORTRAN IV IBM 7094	PHYTCPLANKTCN NUMBERS VOLUME SURFACE AREA
53 MAP 18# 7C94	PHYTOPLANKTCN NUMBERS VOLUME SURFACE AREA

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134 FORTRAN IVUNIVAC 1108SPECTRAL ANALYSIS CF TIME SERIES134 ALGOLB 67C0SPECTRAL ANALYSIS CF TIME SERIES

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136 FCRTRAN IV IBH 370	PRCEASILITY CISTRIBUTION WEIBUL
56 FORTRAN IV IBM 370	RESCURCES ALLCCATILN IN FISHERIES MGT PISCES
56 FORTRAN IV IBM 37C	WATER RESCURCES TEACHING GAME DAM
50 FORTRAN IBP 370	CPTIPAL ECCSYSTEM PCLICIES CEP

WILLIAMS COLLEGE, WILLIAMSTCHN, MA

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25 FCRTRAN IV	IBM 1130	BEACH SIMULATION HUDEL
29 FORTRAN LV	IBM 1130	BEACH AND NEARSHORE MAPS A-S

WOODS HELE OCEANEGRAPHIC INSTITUTION, WOODS HELE, MA

118	FORTRAN	L٧	XDS SIGMA	7	HGRIZCNTAL FISTEGRAMS HISTO
118	FCRTRAN	L۷	XDS SIGMA	7	PRINTER PLGTS LISPLO
119	FORTRAN	I۷	XDS SIGMA	7	PLCT CF FREGUENCY CISTRIBUTION THISTC
119	FCRTRAN	1V	XDS SIGMA	7	VELOCITY VECTOR AVERAGES VECTAV
119	FCRTRAN	1 V	XDS SIGMA	7	FREGRESSIVE VECTORS PREVEC
119	FOR7RAN	17	XDS SIGHA	7	PLOTS DATA ALCNG TRACK
119	FORTRAN	1	XDS SIGMA	7	PRCFILE VERSUS TIME OR DISTANCE
120	FORTRAN	11	HP MINI		PLCTS NAVIGATION WITH ANY OTHER DATA TYPE DEEP6
102	FORTRAN	1 V	XDS SIGMA	7	RAYTRACE
97	FCRTRAN	I۷	XDS SIGMA	7	SCUND VELCCITY SONVEL

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97	FORTRAN	I۷	XDS SIGMA	7	DEPTH CORRECTION MICOR SOUND VELOCITY
148	FORTRAN	I۷	XDS SIGMA	7	EDITING FOR NHOI FORMAT SORUB
143	FORTBAN	I۷	XDS SIGMA	7	THERMCMETER CORRECTION TOPLO
143	FORTRAN		HP 2100		THERPCMETER CCRRECIION DEPTH COMP HYDI
8	FCRTRAN	IV	HP 2100		STATICN DATA HYC2
8	FORTRAN	ÎV	XDS SIGMA	7	BRUNT-VAISALA FREQUENCY OBVFRQ
			XDS SIGMA		
	FGRTRAN		XDS SIGMA		
			XDS SIGMA		
			XDS SIGMA		
			XDS SIGMA		PRESSURE SLERCUTINE PRESS
			XDS SIGNA		REALS STATICN CATA
	FCRTRAN				GECSTFOPHIC VELOCITY DIFFERENCE VEL
			XDS SIGMA		VOLUPE TRANSFEPT VIR
			XDS SIGMA		
	FORTRAN				
	FORTRAN				POTENTIAL TEMPERATURE POTEMP
	FGRTRAN				
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INSTRUCTIONS

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01. Canadasiy E.La. Enter data summary prepared. Use Year, Month, Day format, YYMMDD,

- 02. Cummary Repaired By, Enter name and phone number (including area code) of individual who prepared this summary.
- O3. Summary Action, Early 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 entir, the now 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 delisted, color internal software identification in item 07 of this form; complete all other items as reported in item 07 of the singular summary is to be delisted, color internal internal software identification as reported in item 07 of the singular summary is to be delisted, color internal "Previous Internal Software ID" the internal "Sitware identification as reported in item 07 of the singular summary; complete only items 08, 02, 03 original 18 on this form.
- 04. Convert Cate. Enter date software was completed or last updated. Use Year, Month, Day format: YYMMDD.
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- 07. Unternal Software 10. Enter a unique identification number or code.

Computer Systems Support/Utility Linegoment/Susines

- US. Collicere Type, Mark the eppropriate box for an Automatici Data System (set of computer programs), Computer Program, or Subroutine/Michida, whichever boxt describes the software.
- 63. Processing firsts. Mark the appropriate box for an Interactive, Batch, or Combination mode, whichever best describes the coffware.
- 13. Application Area.

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General: Mark the oppropriate box which best describes the general area of application from among:

Pracess Control

Bibliographic/Textual Other

- Scientific/Engineering Other Specify the sub-area of application; e.g.: "COBOL optimizer" if the general area is "Computer Systems Support/Utility"; "Payroil" if the general area is "Manugement/Business"; etc. Elaborate here if the general area is "Other."
- 31. Eubmitting Organization and Address. Identify the organization responsible for the software as completely as possible, to the Branch or Division level, Exit including Agency, Department (Bureau/Administration), Service, Corporation, Commission, or Council. Fill in complete mailing address, including multi-code, small code, small code, and ZIP code.
- 12. Yachnical Contact(s) and Phane: Enter person(s) or office(s) to be contacted for technical information on subject matter and/or operational aspecta of software. Include telephone area code, Provide organization name and mailing address, if different from that in item 11.
- 12. Harretive, Describe concisely this problem addressed and methods of solution. Include significant factors such as special operating system module coloring, security concerns, relationships to other software, input and output media, virtual memory requirements, and unique hardware features. Other references, if appropriate,
- 24. Kaywords. List significant words or phrases which reflect the functions, applications and features of the software. Separate entries with semicolons.
- 15. Computer Renutacturer and Eludici, Identity mainframe computer(s) on which software is operational.
- 16. Computer Openating System. Enter name, number, and release under which software is operating, Identify enhancements in the Narrahve (item 13).
- 17. (regraming Longuage(s). Identify the language(s) in which the software is written, including version; e.g., ANSI COBOL, FORTRAN V, SINSCRIPT II.5, SLEUTH II.
- 13. Humber of Source Program Statements. Include statements in this software, separate macros, called subroutines, etc.
- Computer Elemony Requirements. Enter minimum internal memory necessary to one full software, exclusive of memory required for the opcrating system. Spacify words, bytes, characters, etc., and number of bits per unit. Identify writial memory requirements in the Narrative (item 13).
- 20. Tape Drives. Identity number needed to operate software. Specify, if critical, manufacturer, model, tracks, recording density, etc.
- 21. Dish/Drum Units, Identify number and size (in same units as "Memory"—item 19) needed to operate software. Specify, if critical, manufacturer, model, stc.
- 22. Yerminola, identify number of terminals required. Specify, if critical, type, speed, character set, screen/line size, etc.
- 23 Other Oppretional Requirements. Identify peripheral devices, support software, or related equipment net indicated above, e.g., optical character solvces, facsimile, conjuter-output microfilm, graphic plotters.
- 24. Software Availability. Mark the appropriate box which best ovacribes the software evailability 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.
- 28. Documentation Availability. Mark the appropriate box which best describes the documentation evailability from emong: Available to the Public, inadequade 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.
- 28. Far 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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