

NEW HYDROGRAPHIC DATA ACQUISITION AND PROCESSING SYSTEM FOR THE ROYAL NETHERLANDS NAVY

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In January 1985 the Royal Netherlands Navy replaced the Hydraul-I data logging system (dated 1973)(**) by a modern Hydraul II system on board the survey ship H.N.I.M.S. *Blommendal*. The sister ship H.N.I.M.S. *Buyskes* received a new system a year later.

Two portable systems are planned for use in the S.M.B.s and for use on board ships occasionally assigned to carry out hydrographic surveying.

When the former Hydraul system was developed, the intention was that the survey ship would sample the data on magtape cassettes, but send the data to the Hydrographic Department for processing. On completion, the plotted fair sheet would be sent back to the ship for checking and the drawing of depth contours, etc. Although the final responsibility for the fair sheet remained with the commanding officer, in practice it was felt disadvantageous that the survey officers were less involved with the fair sheet. So it was decided that the new Hydraul system had to be designed for processing on board.

Since 1984 Netherlands survey ships have been equipped with tide gauges which log digitized data, which enables computerized tidal reduction. Therefore, a large and fast computer had to be chosen with large storage capacity on disc. To be able to run programs simultaneously, a Real Time Operating System was a necessity for the new Hydraul system.

This system, which has been developed by Applied Dynamics Europe (ADE) in cooperation with the Hydrographic Department, is capable of carrying out other tasks simultaneously with the logging task, such as geodetic computations, drawing of pre-plots, processing of tidal data, processing of logged data for the final fair sheet and comparison of the information supplied by the Electronic Position Fixing (EPF) systems for calibration purposes.

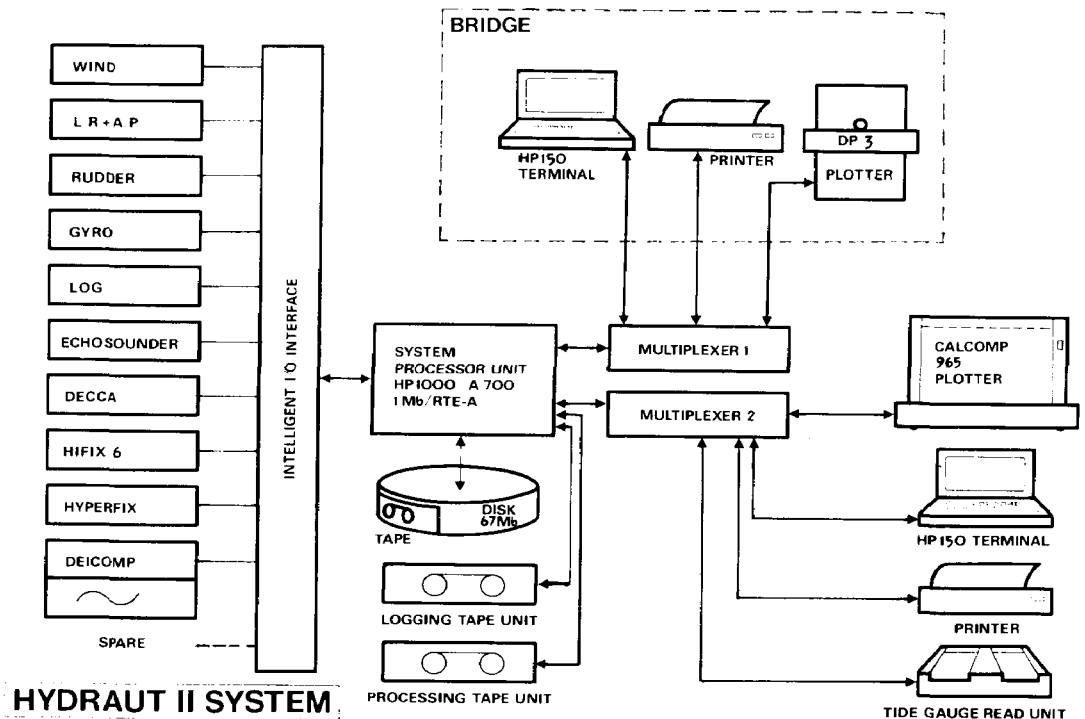
(*) Hydrographic Service, Royal Netherlands Navy, Badhuisweg 171, P.O. Box 90704, 2509 LS 's-Gravenhage, Netherlands.

(**) BUIS, B. : The HYDRAUT Automatic Data Logging System, *I.H. Review*, LII(2), July 1975

HARDWARE

To fulfil these tasks the following hardware was chosen :

1. HP 2197C System Processor Unit which is managed by an RTE-A Real Time Operating System. The core of this SPU consists of an A700 processor with a Hardware Floating Point processor and 1 Mbyte of memory.
2. HP 7912R Winchester Disc Unit with a storage capacity of 67 Mb. A magnetic tape drive is integrated in this unit for data back-up and storage. This tape unit handles streamer tape cartridges measuring 4 by 6 inches. The capacity of the tapes is 16.7 or 67 Mbytes.
3. HP 9144A Cartridge Tape Drive. This tape drive is fully compatible with the integrated tape drive in the disc unit and is mainly used for logging of sounding data onto the streamer tapes as mentioned above.



4. Two HP 45610 terminals. One of these terminals is used as system console and operator's terminal for the off-line tasks, the other as operator's terminal on the bridge. These terminals are the terminal versions of the HP 150 personal computers and have built-in graphics and a touch sensitive screen. The graphics resolution is 512 by 390 pixels. The touch screen of the terminal on the bridge is used by the

duty-officer to operate the logging system, just by touching the required item on the screen, thus reducing the need for pushing buttons on the keyboard. This is regarded as an advantage, especially during hours of darkness on the bridge.

5. HP 2934A printer. This 136 column matrix printer has graphics capabilities with a resolution of 90 by 90 dots per inch. The printing speed is 200 characters per second. This printer is used for making source listings and hard copies of all relevant information on programs not part of the logging task.
6. Wenger printer RO 80/132. This printer is used for the on-line production of a complete back-up log of the survey. This task demanded some special physical and technical requirements for this printer which is installed on the bridge, such as :
 - a. Low noise level.
 - b. Easy to operate.
 - c. Last printed line must be readable without manually shifting the paper up and down.
 - d. Limited dimensions (due to lack of room on the bridge this printer had to be placed in a console above the terminal).
 - e. Possibility (room) to build in illumination.

As none of HP's printers met these requirements the market was scanned and finally the Swiss Wenger printer was chosen. This 80/132 column matrix printer has graphics capabilities and a printing speed of 80 characters per second.

7. Houston Complot DP-3 plotter. This plotter was a part of the former Hydraul system and is again used as a track plotter on the bridge. It is a slow but reliable plotter with a working area of 55 by 300 cm.
8. Calcomp 965 plotter. This high speed plotter has a working area of 86.4 cm by 151.8 cm. A repeatability of ± 0.13 mm is claimed by the manufacturer. This plotter is used for plotting the final fair sheet, drawing tidal curves, making pre-plots, bottom profiles, etc.
9. Deicomp system. This heave compensator is used for reducing soundings to a flat sea surface. It was developed by ADE and consists of a vertical accelerometer, an inclinometer, filtering hardware, and a microprocessor that converts accelerations into heave values, thus relieving the main computer from this task.

The following devices are interfaced to the Hydraul II system :

10. Atlas Deso 10 Edig echo sounder for collecting raw soundings.
11. Decca Mk 21 navigator for positioning.
12. Two Hi-Fix 6/Hyperfix receivers for accurate survey positioning.
13. Speed log and gyro for quality control of the derived positions and for future implementation of an adaptive steering software package.
14. Rudder angle indicator, for future adaptive steering.
15. Left/Right indicator for manual track keeping.
16. Autopilot for automatic track keeping.
17. Windmeter (speed and direction) to facilitate weather reporting and to complete the back-up log of the survey.

18. Dag-6000 read-unit. This unit reads the tidal data from the solid state memory of the Dag-6000 seabed tide gauges which are being used by the survey ships.

The peripherals 2 to 8 and 18 are directly interfaced to the main computer. Sufficient slots are available for future implementation of new devices.

The peripherals 9 to 17 are interfaced to the main computer via an Auxiliary I/O Interface Unit. This unit has its own microprocessor which reads the interfaced sensors, stores the data in a formatted output buffer and sends the data from this buffer to the main computer on request. After quality control, the main computer stores this data by means of disk buffering onto the logging tape for later processing. Sufficient slots are available for future expansion.

SOFTWARE

The logging software has been developed by ADE. It consists partly of 'off the shelf' programs and partly of new software. The software is modular structured and written in the high level programming language FORTRAN 77.

At start up, default initialisation parameters are read from a previously prepared disc file, the file's name being related to the survey area code. If necessary, most parameters can be changed interactively after initialisation.

The touch sensitive display gives the operator full control over the Hydrat system without special knowledge of programming languages or the RTE-A operating system.

Ten different pages can be selected to be displayed on the screen of the operator's terminal. These pages are updated every 10 seconds. Errors and warnings will cause an immediate update of the display, and 'inverse video full bright blinking' of the item concerned until the error is reset manually.

The main page shows the most significant information about the status of the survey. If more detailed information on a certain subject is required, the relating sub-page has to be selected.

The nine sub-pages are : time, position, depth, heave, fixes, left-right, next track, track plot and meteo. A blank page is available for future implementation of utility programs. On the sub-pages the items which can be changed by the operator are placed between brackets. These are : time, Julian day, year, start/stop of Hydrat, central meridian, the (maximum 4) patterns out of the nine available that can be used for positioning, depth sampling rate (maximum 10 per second), draught, fix mark interval, turn direction at end of track, track spacing, track number, track direction, track point, survey borderlines (only used for calculation of end of track time), details of the track plot such as lower left hand corner, scale, skew, size and plot angle, and the windows.

For quality control purposes all sensors have operator-selectable windows. These can be maximum or minimum values or maximum allowable increase or decrease of successive samples. Values exceeding the window settings are flagged and cause a warning message.

Furthermore, on the depth page the uncorrected and the corrected (for heave) bottom profile are graphically displayed, while on the heave page the heave profile will be displayed.

Apart from the items that can be changed, various other commands can be given via the touch screen, such as :

1. Operator-driven event marks for echo sounder events, side scan sonar events, search light sonar events and visual events. After this command, the operator will have to answer relevant questions (e.g. bearing and distance); comment and classification can be added. The track plot will be annotated with labelled special symbols denoting the ship's position and the position of the contact. The relevant information is printed on the survey log and also stored in a separate fixmark disc-file for later processing (e.g. making a plot with only the contacts).
2. Logging on/off. This enables or disables the logging on tape.
3. Next track. This causes the Left-Right indicator and the autotrack keeping to be locked onto the next predefined track. The automatic track keeping can always be switched off by the duty-officer in a split second (e.g. for safe navigation).
4. Update next track point with actual position. This causes the next track to be defined by the actual position of the survey ship and the preset track direction.
5. Track plot on/off. This command enables or disables the plotting of the track. When the track plot is disabled, the pen returns to the lower left hand corner and the plotter commands are neither carried out nor saved.
6. Spooling on/off. As with track plot on/off above, but in this case plotter commands are saved for 15 minutes, giving the operator the opportunity to change the track plot, e.g. clean or refill the pen, etc.
7. Comment. This enables the operator to add text, using the keyboard for entries to the survey log and to the comment files on disk. This is used for information that may be relevant for later processing (e.g. passing tide rips, administrative information on the survey, etc.).

THE SURVEY LOG

The survey log is printed by the Wenger printer on the bridge. At start-up the initialisation file is listed. All items which are changed by the operator during the survey (as explained earlier) are also listed.

On a routine basis all time tagged fix marks (intervals selectable) are sent to the echo sounder, side scan sonar and track plot, and are printed on the survey log together with relevant information such as time, position and depth.

The data logging program is a memory resident program that runs with the highest priority. It can never be swamped by other programs that run concurrently.

The Data Collection and Data Monitoring package consists of a "ten page manual", a main-page and nine sub-pages.

Incorporated sub-pages are:

- The system control-page
- The position systems-page
- The echo sounder-page
- The heave system-page
- The fix control-page
- The left/right-page
- The data logging-page
- The track plotter-page
- The additional sensor-page.

| Applied Dynamics Europe - Hydraut MS - Page 00 | | | | |
|--|----------------|----------------|-------------|--------------|
| TIME 10 32 | POSITION | DEPTH | HEAVE | FIXES |
| DAY 29 | E 588893 | MIN 20 00 | MIN .49 | INT. 2 0 |
| YEAR 1985 | N 5878961 | NOM 20 75 | NOM -.08 | |
| WED 20 MAR | RMS 0 6 | MAX 20 95 | MAX -.49 | |
| HYDRAUT ON | LOG 6 0 | | | |
| DEVICES ON | GYRO 030 0 | S. RATE 10 | Avg .01 | |
| | SPEED 6.1 | DRAUGHT 3 80 | | |
| LEFT / RIGHT (129 /) | NEXT TRACK | TRACK PLOT ON | METEO | NEXT CHAPTER |
| ON | LOGGING ON | | | |
| DIST EDT 19832 | TAPE 67:12 | SLC E 588250 | WIND 210/06 | |
| TIME EDT 01:50 | TURN DIR SB | M 5878700 | | |
| TRCK NR 1 | TRCK SPC 250 | SCALE 1: 25000 | | |
| TRCK DIR 005.0 | TRCK DIR 185.0 | SKEW 005 | | |

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|-----|--|----------|--------------|--|-------------|
| FIX | | COMMENTS | RESET ERRORS | | EXIT SYSTEM |
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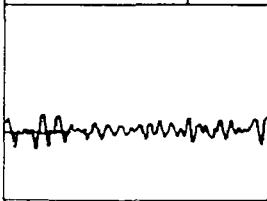
| Applied Dynamics Europe - Hydraut MS - Page 01 | | |
|--|------------------------------|-------------------|
| TIME (UTC) (10 32 02) | HYDRAUT START | HYDRAUT STOP |
| JULIAN DAY (29) | DAY 28 TIME 09 34 | DAY 22 TIME 17 01 |
| YEAR (1985) | | |
| WED 20 MAR 1985 | SURVEY (KY71_UC32) | |
| DEVICE | DEVICE | DEVICE |
| PRINTER ON | H. SYS 11 ON | RUDDER ON |
| PLOTTER ON | H. SYS 12 ON | GYRO ON |
| TAPE UNIT ON | DECCA ON | LOG ON |
| RELEASE TAPE | ECHO SOUNDER HEAVE SYSTEM ON | WIND ON |

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| FIX | | COMMENTS | RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 02 | | | | |
|--|-------------------------|----------|----|-----|
| POSITION | H. SYS11 CHAIN (SAGOH) | WINDOWS | AC | L S |
| GRID (UTH) E (588893) | PATT F1 L1 | | | |
| N (5878961) | 1-2 (+) 3456.78 -1.23 | (20) 0 | | U |
| CENTR. MER. (3 E) | 2-3 (+) 4567.89 4.56 | (20) 0 | | |
| RMS (20 0) 0.6 | 3-4 (+) 5678.90 -7.89 | (20) 0 | | |
| LAT 53 03' 6.4" W | H. SYS12 CHAIN (RIFIX6) | WINDOWS | AC | L S |
| LONG. 4 16' 51.1" E | PATT F1 L1 | | | |
| INT. ELL. | 3-1 () 9867.23 1.30 | (30) 0 | | U |
| | 3-5 () 909.02 -0.10 | (30) 0 | | |
| | 4-2 () 5390.43 2.10 | (30) 0 | | U |
| R. ANGLE (10 0) 0 0 | DECCA CHAIN (-----) | WINDOWS | AC | S |
| GYRO (10 0) 030 0 | PATT READING LANE | | | |
| LOG (2 0) 6 0 | RED () (A0) 0.00 | (20) 0 | | |
| GROUND-READING 030 0 | GRN () (R30) 0.00 | (20) 0 | | |
| GROUND-SPEED 6.1 | PRP () (R50) 0.00 | (20) 0 | | |

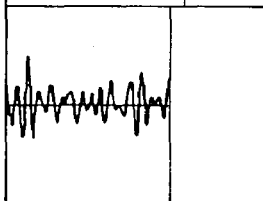
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| FIX | | COMMENTS | RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 03 | | |
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| DEPTH | WINDOWS # OUTS | SAMPLING RATE (10) |
| MINIMUM/TRACK 20 00 | (15.00) 0 ^ | DRAUGHT (3 80) |
| NOMINAL 20 75 | (2.00 , 2.00) 0 ~ | |
| MAXIMUM/TRACK 20 95 | (30.00) 0 v | |



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| FIX | | COMMENTS | RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 04 | | |
|--|---------------------|----------------|
| HEAVE | WINDOWS # OUTS | AVERAGE |
| MINIMUM/TRACK .49 | (1.00) 0 ^ | (.10 , -.10) |
| NOMINAL -.08 | (1.00 , 1.00) 0 ~ | |
| MAXIMUM/TRACK -.49 | (-1.00) 0 v | |



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| FIX | | COMMENTS | RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 05 | | |
| FIXES | | |
| FIX NUMBER 516 FIX INTERVAL (2.0) | | |
| | | EYEBALL MARK EVENT MARK |
| ECHO SOUNDER EVENT MARK | SIDE SCAN SONAR EVENT MARK | SEARCH LIGHT SONAR EVENT MARK |

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| FIX | | COMMENTS |
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| RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 06 | | |
| LEFT / RIGHT (129 /) ON DIST EOT 19032 TIME EOT 01:50 | NEXT TRACK TURN DIR (58) TRACK SPC (250) | BORDER LINES P11 (588250 , 5878700) P12 (588750 , 5898700) P13 (598750 , 5898700) P14 (598750 , 5878700) |
| CURRENT TRACK TRACK NUMBER (1) TRACK DIR. 005.0 TRACK POINT E (588250 , N 5878700) | NEXT TRACK TRACK NUMBER (2) TRACK DIR. (185.0) TRACK POINT E (588499 , N (5878678) | POSITION - NEXT TRACK PNT DIR. 124.8 DIST 495 TIME 00:02 |
| LOGGING ON TAPE 67.12 | NEXT TRACK | UPDATE NEXT TRACK POINT FROM ACTUAL POSITION E 588093 , N 5878961. |

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| RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 07 | | |
| LEFT / RIGHT (129 /) ON DIST EOT 19032 TIME EOT 01:50 | NEXT TRACK TURN DIR (58) TRACK SPC (250) | BORDER LINES P11 (588250 , 5878700) P12 (588750 , 5898700) P13 (598750 , 5898700) P14 (598750 , 5878700) |
| CURRENT TRACK TRACK NUMBER (1) TRACK DIR. 005.0 TRACK POINT E (588250 , N 5878700) | NEXT TRACK TRACK NUMBER (2) TRACK DIR. (185.0) TRACK POINT E (588499 , N (5878678) | POSITION - NEXT TRACK PNT DIR. 124.8 DIST 495 TIME 00:02 |
| LOGGING ON TAPE 67.12 | NEXT TRACK | UPDATE NEXT TRACK POINT FROM ACTUAL POSITION E 588093 , N 5878961. |

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| RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 08 | | |
| TRACK PLOT SURVEY HY71_LC32 LLC E (588750 ,) N (5878700 ,) | SCALE 1: (25000) SKEW (5) SIZE (45 , 150) | PLOT ANGLE (5) PLOT INTERVAL (1) |
| TRACK PLOT ON | TRACK PLOT SPooling OFF SPARE TIME 0:16 | PRE-PLOT BREAK |
| GRIDS | PATTERNS | POINTS |

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| FIX | | COMMENTS |
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| RESET ERRORS | | MAIN PAGE |
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| Applied Dynamics Europe - Hydraut MS - Page 09 | | |
| TEMPERATURE DRY BULB 15.0 C / 59.0 F WET BULB 4.0 C / 39.2 F WATER 10.0 C / 50.0 F | HUMIDITY / AIR PRESSURE MAX 92.1 % 1013.1 mBar MIN 95.2 % 1012.0 mBar MIN 84.6 % 1012.0 mBar | SALINITY |
| WIND DIR KTS M/S BFT REL 110 2 1 1 ABS 132 3 1 1 AUR 132 3 1 1 | WATER DIR KTS M/S 182 1.2 .6 | |

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| RESET ERRORS | | MAIN PAGE |
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The "next-chapter-page" allows user defined pages to be added to the standard system. In this way an optimum installation can be configured, fulfilling any specific needs.

The Hydrat Series Processing package (option) consists of a "ten page manual", a main-page and nine sub-pages.

Incorporated sub-pages are:

- The system control-page
- The pre-view profile-page
- The off-line track plot-page
- The data edit-page
- The reduction-page
- The selection-page
- The fair sheet-page
- The selected profile-page
- The grids/chart plot-page.

| Applied Dynamics Europe - Hydrat M5 - Processing System - Page 00 | | | | |
|---|---------------------|--------------|----------|-----------------|
| CONTROL | PRE-VIEW PROFILE | TRACK PLOT | EDITORS | REDUCTION |
| SELECTION | FAIRSHEET | PROFILE PLOT | PRE-PLOT | NEXT CHAPTER |

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| CI | | BREAK | | | | EXIT SYSTEM |
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| Applied Dynamics Europe - Hydrat - Processing System - Page 01 | | |
|--|---|---|
| TAPE INDEX | RELEASE TAPE | DISC INDEX |
| | PROCESSING SOURCE TAPE UNIT 1 (+) TAPE UNIT 2 () | SESSION NR. 1 CONSOLE : 1 PRINTER : 6 TAPE UNITS : 8 28 PLOTTER : 7 |
| TAPE MERGE | PLOT ROTATION (HORIZONTAL) MAX X-LENGTH: 75 | |

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| Applied Dynamics Europe - Hydrat - Processing System - Page 02 | | |
|--|---|--|
| TAPE INDEX | MANUAL PRE-VIEW | AUTO PRE-VIEW |
| CURRENT TAPE FILE (I) SURVEY: HY71_LC33 NR : 3.11 SKIP :M2 DATE/TIME 131/85 06:11:39 SCALE 1 : 50000 | PLOT DEFINITION POS. SC. 1: (999999) DEPTH SC. 1: (200) BEGIN (001/85 00:00:00) END (001/85 00:00:00) | PLOT DEFINITION POS. SC. 1: (75000) DEPTH SC. 1: (200) |
| CURRENT TAPE FILE (II) EDT : /D RED: / | START PLOT | DEPTH TAGS (Y) RED. PROFILE (N) SEL. PROFILE (N) D. LINES FILE (KH) |

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| Applied Dynamics Europe - Hydrat - Processing System - Page 03 | | |
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| TAPE INDEX | TRACK PLOT | |
| CURRENT TAPE FILE (I) SURVEY: HY71_LC33 NR : 3.11 SKIP :M2 DATE/TIME 131/85 06:11:39 SCALE 1 : 50000 | LLC E (508531.) N (5804977.) | |
| CURRENT TAPE FILE (II) LLC : E 508531. N 5804977 SKEN: 036 PLOT ANGLE: 60 EDT : /D RED: / | SCALE 1: (50000) SKEN (036) SIZE (55. 00) PLOT ANGLE (0) | |

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| CI | | BREAK | | | MAIN PAGE |
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| Applied Dynamics Europe - Hydrat - Processing System - Page 04 | | |
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| TAPE INDEX | TAPE EDITOR | FIX FILE EDITOR |
| CURRENT TAPE FILE (I) SURVEY: HY71_LC33 NR : 3.11 SKIP :M2 DATE/TIME 131/85 06:11:39 SCALE 1 : 50000 | | |
| CURRENT TAPE FILE (II) EDT : /D RED: / | | |

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| Applied Dynamics Europe - Hydrant - Processing System - Page 05 | | |
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| TAPE INDEX | REDUCTION | |
| CURRENT TAPE FILE (I) SURVEY: HY71_LC33 NR : 3.11 SHIP :M2 DATE/TIME 131/85 06:11:39 SCALE 1 : 50000 | | |
| CURRENT TAPE FILE (II) | | |
| EDT : /D RED: / | | |

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| Applied Dynamics Europe - Hydrant - Processing System - Page 06 | | |
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| TAPE INDEX | SELECTION | DISC INDEX |
| CURRENT TAPE FILE (I) SURVEY: HY71_LC33 NR : 3.11 SHIP :M2 DATE/TIME 131/85 06:11:39 SCALE 1 : 50000 | SELECTION TYPE SCALE 1: (25000) NUMBER HEIGHT (.16) | |
| CURRENT TAPE FILE (II) | | |
| EDT : /D RED: / | | |

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| Applied Dynamics Europe - Hydrant - Processing System - Page 07 | | |
|--|---|---|
| | FAIR SHEET | DISC INDEX |
| CURRENT DISC FILE (I) SURVEY: HY71_LC33 NR : 3.11 SHIP :M2 DATE/TIME 131/85 06:11:39 SCALE 1 : 50000 | PROJECTION (U.T.M.) LLC N (500531.) N (5004977.) | PEN OPTION (M) DEPTH LINES (Y) D. LINES FILE (KM) MIN DEPTH MK (Y) DELTA LEVEL (0.00) |
| CURRENT DISC FILE (II) | SCALE 1: (25000) SKEW (000) SIZE (75 , 135 , 15) PLOT ANGLE (0) NUMBER HEIGHT (.16) | ROUTING (P) |
| EDT : /D RED: / | | |

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| Applied Dynamics Europe - Hydrant - Processing System - Page 08 | | |
|--|---|----------------------|
| | PROFILE | DISC INDEX |
| CURRENT DISC FILE (I) SURVEY: HY71_LC33 NR : 3.11 SHIP :M2 DATE/TIME 131/85 06:11:39 SCALE 1 : 50000 | PLOT DEFINITION POS. SC. 1: (999999) DEPTH SC. 1: (200) BEGIN (001/85 00:00:00) END (001/85 00:00:00) | |
| CURRENT DISC FILE (II) | | D. LINES FILE (KM) |
| EDT : /D RED: / | | |

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| Applied Dynamics Europe - Hydrant - Processing System - Page 09 | | |
|---|--|----------|
| GRIDS | MARGIN | TITLE |
| POINTS | PROJECTION (U.T.M.) LLC E (500531.) N (5004977.) C.M. (3) | PATTERNS |
| | SCALE 1: (50000) SKEW (036) SIZE (55 , 80) MIN INT. (0) | |
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| | | | MAIN PAGE |
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Additional processing sessions can be added to the system. Each additional session increases the productivity of the system and therefore an optimum use of the available computing power can be achieved.

PROCESSING

Like the logging package, the display menu of the processing consists of ten pages, following the normal sequence of the processing process.

These pages are : main-, control-, preview-, track plot-, editor-, reduction-, selection-, fair sheet-, profile-, and preplot-page. The functions of the pages are briefly described below.

However, first it is essential to understand which information is written on tape.

A track on tape is called a logging file, being the period and entries between the commands «logging on» and «logging off».

Every file has a header record with administrative information such as ship's name, survey area name, scale of survey, etc.

Every three minutes a record with statistical information is routed to tape such as average ground speed, maximum heave correction, lane ident values, etc.

Every second a logging record with hydrographic information is written on tape. The record contains :

- 10 raw depths from the echo-sounder
- 5 heave corrections from the heave system
- 10 heave corrected depths
- max. 4 and min. 2 lines of position from the electronic position fixing system with the patterns in use
- file name with chain data
- calculated and least square adjusted UTM position
- gyro reading
- error and quality control words.

Main page

On this page the operator can select one of the other nine processing pages.

Control page

On this page the processing tape unit can be defined; an index of the files on tape can be made; several short tapes can be merged into a large tape with data of the whole survey; and a 90 degree rotation of the plotter can be chosen.

Preview page

Via this page depth profiles can be plotted on the plotter with associated track and fix marks. This can be done immediately after a line has been completed or even after half an hour of surveying. The values that were flagged by the quality control parameters are tagged on the profiles, while their color indicates the kind of error.

Track plot page

Using this page the track plot can be replotted from the tape. This is very convenient if corrections to readings or chain data have to be applied after the survey, or if overlaps have to be deleted (see editor page).

Editor page

On this page the operator can alter the depth and position information with the interactive graphic editor. Necessary alterations could be : deleting faulty depth caused by air bubbles, fish, etc., correcting errors in assumed draught, or sound velocity, applying C-O corrections to readings of the EPF system, deleting overlaps, etc. If editing blunders are made, it is possible to restore the original values on tape with the simple UNDO command. This can even be done weeks after the original editing has taken place.

Reduction page

Through this page the tidal reduction can be applied and added to the tape.

Selection page

By means of this page the selection of the depth figures for the final fair sheet takes place, based on scale and number height.

Fair sheet page

Using this page the selected depths may be plotted on the Calcomp plotter

Profile page

By means of this page, profiles are plotted of the heave and tidal reduction corrected and selected depths, with lines connecting them. These profiles can be plotted on top of the profiles of all the sampled depths (thus 10 depth/sec) as a check of the selection.

Preplot page

This page enables the plotting of the base sheet for the fair sheet and track plot, i.e. grids, EPF patterns, margins and legends. Points can be plotted on this sheet also.

Apart from the final fair sheet, other final products are :

- Merge tape with all the corrected data for filing in the bathymetric data base in the Hydrographic Department.
- Floppy disk with a copy of the fair sheet.
- Floppy disk with offshore tidal information for analysis and updating of the co-tidal and co-range charts.
- Chart with wrecks and obstructions that were found.

- Floppy disk with wreck and obstruction information for updating the data base in the Hydrographic Department.

OTHER SOFTWARE

1. The software package includes a program to draw preplots. Preplots are track plot charts of areas that are going to be surveyed. They contain borderlines, UTM-grid, geographical grid and the lattices of the positioning system that is going to be used for the survey. The necessary chain data is read from a disc file. The plots can be drawn on the Calcomp plotter and also on the track plotter during surveying if the spooling function is applied.
2. Calibration program. This program reads all connected positioning systems, stores them on tape and/or printer and performs calculations for calibration.
3. Off-line geodetic computations. Programs to perform computations like geographicals to grids, to readings and vice versa with the option to plot the computed points.
4. Processing tide-gauge data. This program reads the solid state memory cassettes of the seabed tide-gauges, applies the corrections and plots the tidal curves.
5. Automatic tidal reduction. This program calculates the tidal correction that has to be applied to the soundings, using tide-gauge data, co-tidal chart and position data from the logging tape.