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LIFTING AND FAIRING SHIP LINES

DATA ON A TEKTRONIX 4052

by P.A. Wilson

Ship Science Report No 9/81

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PREPARATION   OF   DATA   FOR   HYDROSTATICS   PROGRAM   USING
TEKTRONICS   4051/2 AND DIGITAL PLOTTER 4662

This is an alternative method to that of lifting data from
a ship body plan by hand.

Data is digitized from the Plotter and the 4052 and then
can be displayed and faired on either the 4051 or 4052. A data
tape is then produced which is used as the input for the hull
definition programme. The data tape is read directly from the
405N to the ICL 2970, or to the Apple computer for use with the
hydrostatics package that is documented in the blue folder.

To help with the scaling of the drawing, two extra points
must be marked on body plan. These should be at point A, which is
0.5 cm wider than the largest half beam of the ship, and on the
horizontal line passing through the lowest point .of the ship
keel; and at point B which is 0.5 cm wider than the largest beam
and 0.5 cm higher than the highest section depth. This enables
a window to be produced so that the ship lines can be displayed
on the computer screen.
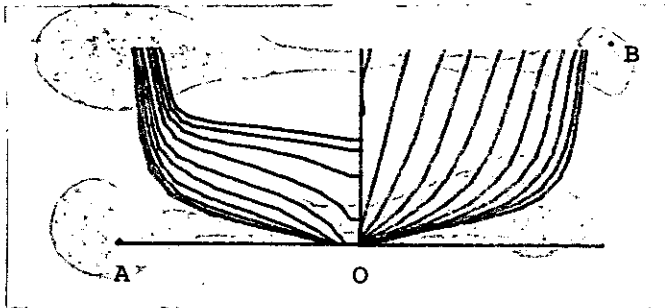
The procedure for lifting the data is as follows:

1. SETTING UP THE PLOTTER

a. Switch on the plotter; press down the LOAD button.

b. Place the body plan on the plotter platten, with the
line   OA horizontal. Now release   the LOAD   button. This,
electrostatically, holds the body plan to the platten.

c. Remove the fibre pen that is probably in the cursor,
and replace with the clear cross hair plastic cursor, or a fine
point drawing pen such as a Rotring.

d. Move the cursor with the joystick control on the

plotter until the centre of the cross hairs is over the centre of point A.

      e. On the plotter in the section marked SET, press down the button marked LOWER LEFT. Keep this depressed until a 'ping' noise is heard. This takes about five seconds and sets the lower window corner co-ordinates.

      f. Move the cursor until the centre of the cross hairs is over the centre of point B. Then press the set UPPER RIGHT button until the ping noise is heard. Again this takes about five seconds and sets the upper right co-ordinates.

      g. As a check that you have set these points correctly, in the box marked LOCATE on the plotter, press the lower left, then the upper right. The cursor should go to A then to B. If this does not happen start at (d) again.

2. LOADING THE PROGRAM

      a. Switch the 405N computer on. When the screen is completely covered with a bright green glow, press the PAGE key, to clear the screen.

      b. Place the magnetic tape cassette into the gap at the front with the clear plastic towards the screen and the hinged piece at the top.

      c. Press the key marked autoload. This loads the program into the computer, and runs the program.

3. LIFTING THE DATA

This section refers to the ship stations as sections. The aftermost section is numbered 1 and the rest are numbered sequentially forward. Thus if there are 22 sections, the most forward station is section 22.

From this point onwards various questions and statements are made on the computer screen. Answer these either YES or NO, or a number as appropriate. After every question reply, press the return key.

This computer has the facility of being able to repeat a character by leaving your finger on that key. Thus do not rest your finger on the keys.

To remove a mistake or mistyped word, press the backspace key until the screen cursor is over the character that is to be changed, then type its replacement. Then proceed where you left

off by pressing the space bar so that the cursor returns to where
you left off typing before.

It is not recommended that more sections are input at some
other time after a data tape has been created, because the window
on the plotter will not be exactly the same, so take all the data
off at one go.

The first question to be answered is

"Do you want to enter a ship from tape?"

For a new ship type NO, for a ship already on magnetic
tape file type YES. A new ship can only be entered from the
4052. If YES, this causes the contents of the tape to be
displayed by file order, with names by the file number.

For a ship on file the next question is :-
"What is the tape file number of your ship?"

Then type the file number. This causes the ship data to be
read off the tape file, that has been specified. After about 15
seconds on the 4052 and 1 minute on the 4051, the screen will
clear and the ship body plan will be drawn.

For a new ship the procedure is as follows: "Do you want
the values printed on the printer?"

that is do you want a hard copy of the input data values.

a. SETTING UP THE DRAWING

The plotter cursor moves to the point O on the plotter. A
question is posed as to whether the cross hairs centre and O are
coincident. If the answer is NO, then a 10 second delay allows
you to manoeuver the drawing so that they are coincident. Do not
move the cursor. After the delay, the cursor moves up the
vertical centreline and poses the question "Is the drawing
vertical?", i.e. is the vertical centreline beneath the cross
line. If the answer is NO, then a 10 second delay allows you to
manoeuver the body plan so that it is. After the delay the cursor
moves to O to repeat the process again. These two questions are
repeated until the body plan is centred at O and also vertical,
so the drawing is now square relative to the computer window.

The next question is "Move the x-y plotter along the vertical axis a known distance in real units." Move the cursor to some waterline (e.g. the 8 m waterline). The next question is "What is this distance?" In this example type 8.0. Now press any key, the drawing is scaled vertically now.

The next question is "Move the x-y plotter along the horizontal axis a known distance in real units". Do exactly as for the vertical scaling, but use horizontal distances. The horizontal and vertical distances do not have to be the same.

The screen now clears and the horizontal and vertical scaling factors are printed on the screen.

The same rules apply to lifting the data by this method as with the method by hand, namely start at the lowest point that is on the centreline. The cursor moves to 0.

1. Move the cursor to the first point on the aft most section of the body plan.

2. Press any key on the keyboard other than E T N or X if the section point is other than the last one on the section, do not follow by a return.

3. Move the cursor to the next point and repeat 2. If the point is the last point of the section then type E if the section is not the most forward section, in this case press T.

E (for end of section)

T (for termination of ship)

A maximum number of 26 points per section is allowed, if you try to exceed this, the machine makes a loud noise, then returns the cursor to the point 0 for you to input that section again with less points.

If for any reason you are not satisfied with the section you have input, say because you have repeated another section and have not already pressed E or T, then press N. This causes the point for the section you are inputting to be removed, and the cursor to be put at 0. This allows you to continue correctly.

When the last data point for the most forward section has been input, and T has been pressed, the display screen clears, followed by the ship data that you have input being displayed with straight lines joining the data spots. Two questions are now asked, after the last section has been displayed.

1. "Do you have any duplicate sections?"

If the answer is YES, the next question is

"Input the duplicate station numbers."

This means, for example, if sections 14 and 15 as displayed are identical, then type 14, 15 (return). This will eradicate section number 15, and remove one from the total number of sections. All those sections that were previously above 15 are renumbered by 1 less, e.g. the old 16 becomes 15 etc.

The body plan is again displayed with the duplicate section missing. Question 1 is posed again, so that any other duplicate sections can be removed.

When the answer is NO, question 2 is posed.

2. "Do you have any missing sections?"

If the answer is YES, the next question is

"After which section number should it be?"

If, for example, there should be a section between number 19 and 20 as displayed on the screen, then type 19. This causes the computer to re-assign the data to make space for an extra section. The cursor on the plotter moves to 0, to allow you to input the missing section.

At the last point of this section, press X. This is to tell the computer it is an extra section.

If you want to input data for a station aft of the first station displayed type 0, because the first station is number 1.

When the answer to question 2 is NO. Then it is worthwhile taking a hard copy of the data input so far. To do this, remove the plastic cursor, in the plotter pen and replace it with a fibre pen. Press the LOAD button down, remove the body plan and replace with a clean sheet of paper, press the LOAD button up. At this point press key number 9. This causes a straight line fit to your data points to be plotted on the paper.

Having obtained a hard copy of the input data, it is now possible to modify the data as follows:

Press user key 18

This causes the statement

"Input section number, if no more sections type 0."

Work through all the sections sequentially.

So typing 1 (return) causes section 1 to be displayed with information about the number of points. The input points are marked with an X, and are joined with straight lines. Three questions need now to be answered. The section will be displayed not exactly as drawn, this is because the window on the computer that is used compresses the x-distance, but does not affect the fairing process.

1. Any Duplicate Points?

This is to remove points that have been duplicated by whatever means. The numbering of points to from the keel upwards. So type YES or NO. If YES this causes the statement

"Input the point number that is extra"

Of course this leaves a choice, say points 10 and 11 are the same, so either 10 or 11 could be typed. After the return key, the screen clears, and the section is redisplayed with the point removed.

Question 1 is now posed again. When this is answered with NO then question 2 is posed.

2. Move any Points?

Using your judgement, some of the input data may be unfair and the points may need moving. So answering YES causes the " " symbol to be displayed at the centre of the screen. This is the location cursor. It can be moved to anywhere on the screen. So move the cursor to the point, that is to be moved. (This is done with those keys numbered in the appendix).

Now press key 7. This finds the data spot's coordinates and also the nearest data point to the arrow. It will be this point that will be moved. Move the location pointer to where the data point should be. Press key 8. This inputs the new data points coordinates. The section is now redisplayed, with this new point replacing the old point. Now question 1 reappears. When finally NO is the answer to question 2, a third question is posed.

3. Any Extra Points?

Bearing in mind that parabolas are fitted to groups of 3, it may be prudent to insert a point, so that a sharp increase in curvature does not arise at mid point of the parabola.

When the answer to 3 is YES, the location pointer appears at the centre of the screen. Move it to where the extra point should be. Press key 14. The display clears and the section is replotted, with questions 1, 2, 3 being re-posed. When the answer to 3 is NO, the section is redisplayed, but with parabolas fitting the data points.

After the section is complete it is possible to plot the section on the plotter, by answering the next question YES.

Now move on to the next section, and repeat the process. When the whole ship has been faired type 0 as the answer to the question.

A display of the whole ship is now given followed by the screen clearing and the question

"Ship length?"

Input the ship length in the correct real units. The next question is

"Is the ship in 23 standard B.S.R.A. sections?"
i.e.

If the answer is NO the next question concerns the station spacing. If it is standard it means the ship is defined at stations in one of two ways, either

0, ¼, ½, ¾, 1, 1½, 2, 2½, 3, 4, 5, 6, 7, 7½, 8, 8½, 9, 9¼, 9½, 9¾, 10 (YES1)
0, ½, 1, 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10 (YES2)

Otherwise enter the distances of the stations relative to midships. Positive is defined as forwards.

The next question is:
"Input the keel depth of mid-section relative to point 0"

When one of these three methods of specifying the station spacing has been chosen then the magnetic cartridge will rewind and display on the screen the contents of the tape.

It is possible to write your ship information onto an existing file, and a series of questions are given to lead you through. Do not worry as to whether the ship data will fit onto a certain file, the programme tests for this. If no file exists then put your data onto the file number opposite LAST.

Note the number that is next to the LAST file. This is
your new file number. After the tape has finished the question
"Input the number that is opposite last" is displayed.

Questions follow about the title, remember a ';' at the
end of the title. When "number of draughts" appears, type
whatever number you require, including 0. Then input the draught
list each one followed by return. The tape file is now finished.

The next question is whether to calculate on the Apple or
not. If NO then the following appears, if YES then skip to the
nearest section. Now the 405N, changes the program to connect to
GANDALF. If you obtain the message no V.M. available, try later.
To connect to the GANDALF later type the following:

        FIND2
        OLD
        RUN

        All followed by return.

Having made contact with the 2970 via service 23. Type
control A, control X. This causes a question which has to be
answered MAC. The 2970 does not use a return key after the end of
a data but control C, so after MAC use control C. This causes
the statement

        LOGIN(,

Finish this with : SIU001.WILSON) control C. Where you use
your name instead of WILSON. Now press RETURN TO BASIC key
followed by the USER KEY ON LINE. After a few seconds, a minus
sign (-) appears, type SOINF(WILSON) where you substitute your
name for WILSON, do not press control C after the) but the FILE
key on the user keys. This causes FILE? to be displayed. Type
your number followed by RETURN, not CONTROL C.

When the tape unit has stopped chuntering press the DATA
SEND key on the user keys.

Then sit back and watch as the data is read from the
magnetic tape into the 2970.

When the screen is full the page button can be pressed to
clear the screen, but is not absolutely necessary.

When the whole of your file has been read, a minus sign
appears, type the following to run the hull definition program

```
EXLBL(MACROS) (CONTROL C)
RUN3(WILSONIN,WILSONOUT,WILSON) (CONTROL C)
```

This causes the hull definition program to read data from WILSONIN, create an output file WILSONOUT, with the results on, and a file WILSON for use with the other hydrostatic programs. Where WILSON appears put your name, e.g. BROWNIN.

After this job has run, to get a copy of your results, on line printer paper (to be collected from pigeon hole 2 in computer reception) e.g. the contents of the hull definition type the following

```
GLKF(WILSONOUT) (Control C)
SOXF(WILSONIN) (Control C)
```

This last statement causes the input file to be deleted, after being printed. Now proceed as before with the running of programs by cards. Type

```
LOGOUT(Y) (Control C)
```

APPLE HYDROSTATICS

If this option has been decided then a page of text is displayed which basically says to link the communication port on the Apple to the J93 RS232 port on the Tektronix.

To activate the Apple, switch on at the rear of the machine, and also the video. This causes the disk drive light on drive one to come on. Insert the hydrostatics disc and close the door. When the light goes out, the video will display some characters. Type on the Apple IN#2, followed by return, then control A, then control F. (this means hold control and A together, similarly for control F). This causes a flashing A on the Apple. Now follow the questions on the Tektronix. The data takes about 5 minutes to transfer. At the end of the job, the Apple writes all the data onto the disc in drive 1. The Tektronix can now be turned off after rewinding the magnetic tape.

To run the hydrostatics on the Apple, consult the blue manual and follow the instructions to the letter. The first job to do is to Hull define the data you have just fed across from the Tektronix. Thus there should be no need to plot the data on the Apple.

If for some reason the Apple is unavailable for transferring data, to run the data across type on the Tektronix, when the Apple is available.

FIN3
OLD
RUN

@

APPENDIX 1

User definable keys.

1. ↑ (slow)
2. ← (slow)
3. → (slow)
4. body plan on screen
5.
6. ↓ (slow)
7. find the indicated point
8. new point to replace (7)
9. body plan on plotter
10. put ship on tape file
11. ↑ (fast)
12. ← (fast)
13. → (fast)
14. input extra point from screen
15.
16. ↓ (fast)
17.
18. look at individual sections
19.
20. 3-D view of ship

        For the 3-D view of ship, after defining the ship to be
fair, press key 20 and follow the instructions.   This causes the
ship to be displayed on a straight line fit in three dimensional
orthogonal projection.

        The questions asked all relate to rotation angles in
degrees, about the x-axis, the fore / aft axis
        the y-axis, the starboard / port axis
        the z-axis, the vertical axis.