# Section 7
# ASSET MONOCV TUTORIAL

# Version 4.3.0

## Section 7.1 – INTRODUCTION

The purpose of this tutorial is to teach the user to use the ASSET MONOCV program for preliminary carrier design. A practice ship design has been included showing, step by step, the design process used when using ASSET. This tutorial covers the entire ASSET aided design process, from design requirements – to inputting and running each module – to running synthesis to obtain a converged model – to design refinements.

ASSET can be used for various tasks within the domain of naval architecture. One of the most common uses of ASSET is performing design trade studies for an already existing design. In this case, the user quickly sees the impact of design changes to a particular design. In the following tutorial, the goal is to acquaint the user with as many aspects of the program as possible. The tutorial you are about to begin will start with a "blank sheet of paper". Working from a list of requirements you will generate a new ship design. This process will cover all ASSET modules in the carrier program – MONOCV. At the end of the tutorial you should have a better understanding of how ASSET MONOCV operates and what information is requires from the user.

**<u>Note</u>: This tutorial assumes that you are familiar with principles of naval architecture. This assumption has been made to keep this tutorial focused on the operation of ASSET and not a crash course in naval architecture.**

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## Section 7.2 – DESIGN REQUIREMENTS

The first step in carrier design is to understand the design requirements as they relate to the ship design. Some of these values will be initial estimates that can be adjusted later as the design becomes more refined.

**Ship Type**
Medium Sized Conventional Take Off and Landing Carrier

**Ship Performance**
Sustained Speed: 26 knots
Endurance 8000nm @ 20 knots

**Air Wing:**
10 F-14A
20 F-18C
3 E-2C
3 KA-6D
6 S-3A
3 EA-6B
4 SH-60

**Combat Systems:**
4 CIWS mounts
2 NSSMS launcher

**Propulsion Plant**
2 Propulsion shafts
2 Main Machinery Rooms (MMR)
2 1200psi Steam Plant Main Engines
2 Auxiliary Machinery Rooms (AMR)
4 Ship Service Steam generators
4 Diesel Ship Service (Emergency) Generators

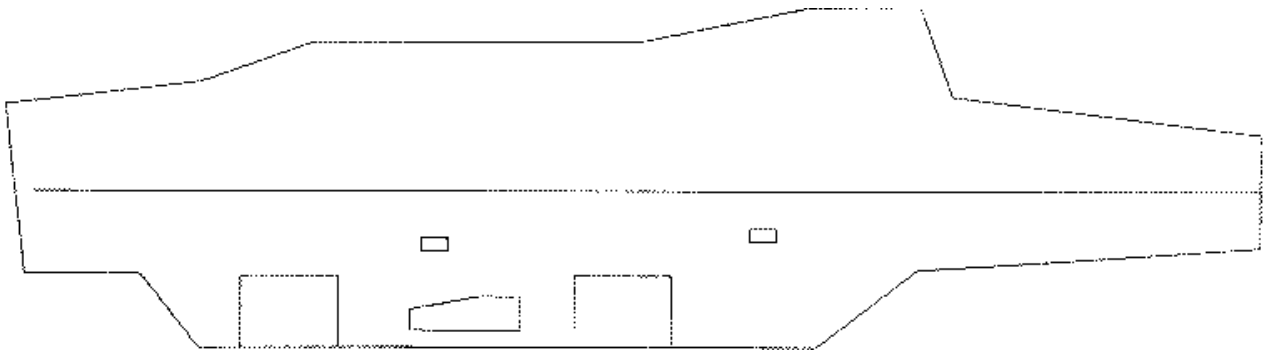
**Manning**

| | Ship's Crew | Marines | Air Det. | Flag Staff |
|---|---|---|---|---|
| Officers | 89 | 2 | 198 | 17 |
| CPO | 71 | 1 | 89 | 13 |
| Enlisted | 1569 | 62 | 1081 | 17 |

## Section 7.3 – GENERAL LAYOUT

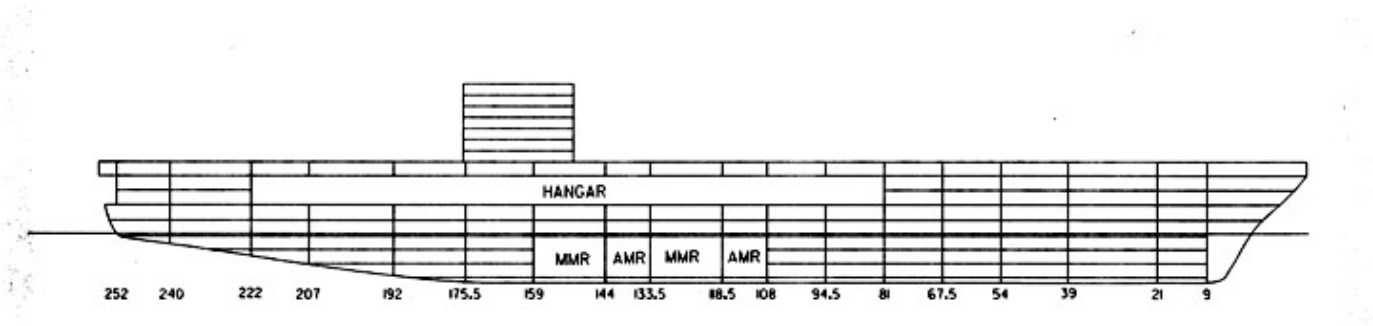
The first step in the design is to create the general layout of the carrier. This will include the flight deck layout with the associated elevator and hanger layout. The length of the ship will be driven primarily by the requirements of the flight deck. The inboard profile shows the location of large object spaces in the ship such as the MMR's, AMR's, hanger and magazines. The space required for these elements can be estimated from previous designs.

For our design, the length was estimated to be 259m. It should be noted here that this tutorial will be using metric units. ASSET defaults to this setting so no adjustment is necessary (available under the *Options* menu in ASSET).



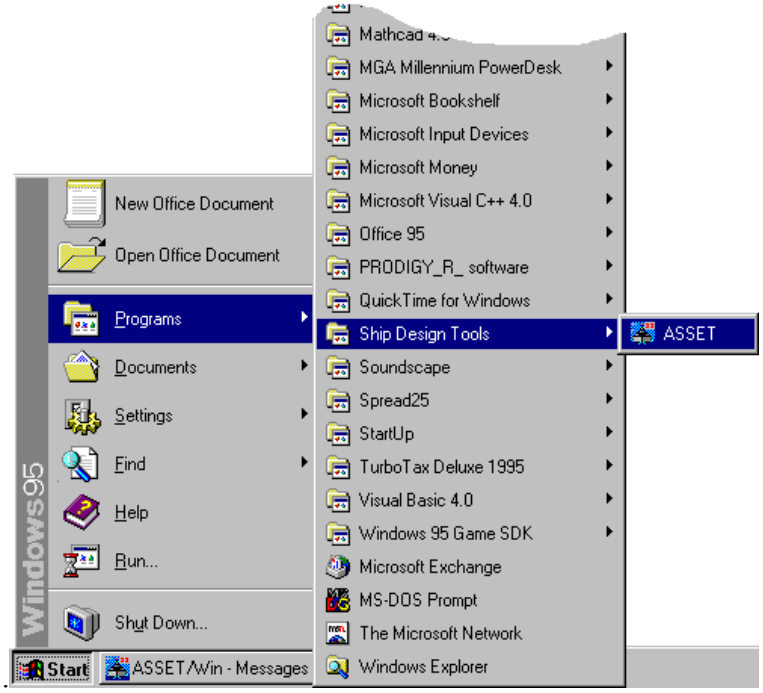
ASNE report available on flight deck design.

The inboard profile will define the location of decks, transverse bulkheads and large object spaces such as hangers, machinery rooms and magazines. The inboard profile will be used as a guide for defining these elements in ASSET.

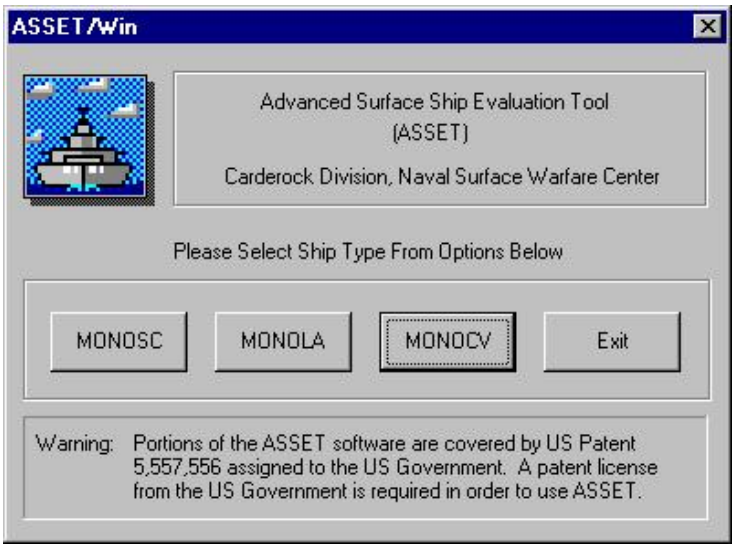


## Section 7.4 – STARTING ASSET

Start ASSET by selecting the ASSET menu item from the Start Menu. It should be in the Ship Design Tools folder

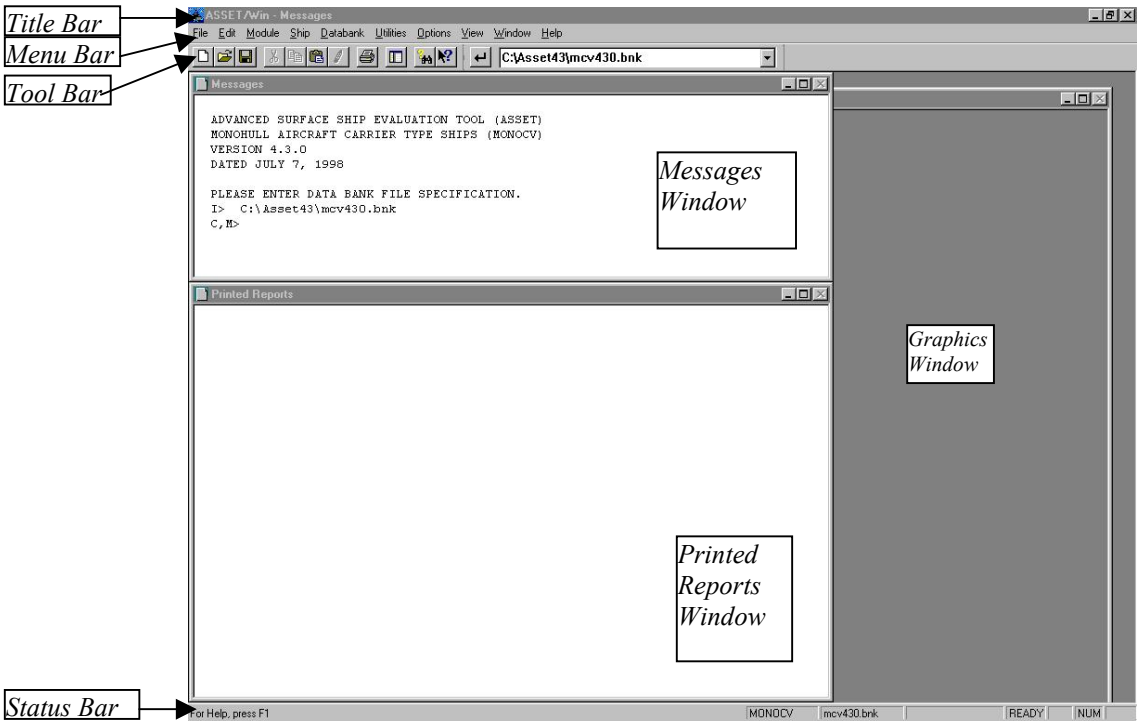



The first dialogue box to appear prompts the user to choose a ship-type-specific program from ASSET's family of programs. Since we are designing a carrier, choose the MONOCV command button. The dialogue box looks like this:



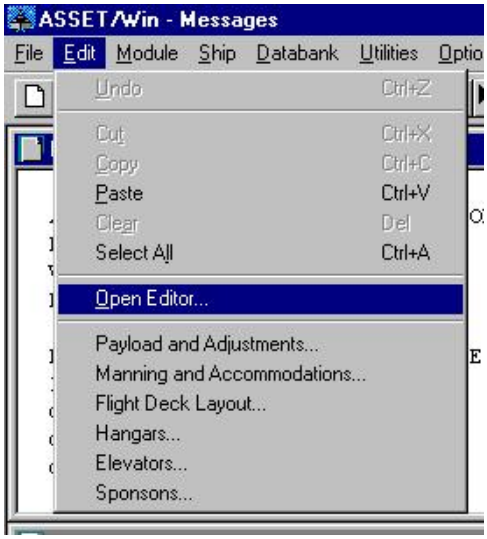
The main window for ASSET will be displayed, and the Attach Databank dialogue will appear. Since you will be using information stored in the **mcv430.bnk** data bank, select **mcv430.bnk** from the file list and click **OPEN**. The dialogue box will look like this:

After attaching the databank, the three output windows (Messages, Printed Reports, and Graphic Reports) will appear. Notice the status bar; it is indicating that the MONOCV program is running, that you have attached the **mcv430.bnk** and that ASSET is ready for the next command. **Note**: The number in the data bank name indicates which version of ASSET you are using. You may have a later version than Version 4.3.0.



## Section 7.5 – THE ASSET EDITOR AND MISSION REQUIREMENTS

The primary tool for entering data into ASSET is the ASSET editor. Clicking on **Edit** from the menu bar, then selecting **Open Editor…** accesses the ASSET editor.




The Edit button on the toolbar also accesses the Editor. The ASSET Editor operates similar to a spreadsheet program like Excel. Note that when the editor is open, the menu bar across the top changes. Selecting the folders on the left side of the editor allows the user to navigate through ASSET parameters, called the Model Parameter List (MPL), similar to navigating through a file directory tree in Explorer. In addition, you can find a parameter by name using the **Find** command. Clicking on **Edit** from the menu bar then selecting **Find** operates the **Find** Command. There is also a **Find** button on the Toolbar (binoculars). Use the **Find** Command to locate the SHIP TYPE IND parameter.

The ASSET editor also provides access to the Help Index. There are Help descriptions available for every parameter that explain what the parameter defines within the ASSET model. Selecting **Help** from the menu bar, then selecting **Index** opens the help index. Once you are in the Index form, you can enter the name of an ASSET parameter to call up the description of the parameter. The index form will jump ahead in the list of parameters with each letter you type. Enter SHIP TYPE IND in the Index Form. You can see that for this tutorial the value of this parameter will be CARRIER. Enter **CARRIER** in the Editor for SHIP TYPE IND. The up and down arrows in the tool bar allow the user to navigate the list of parameters. Use this to move down to the

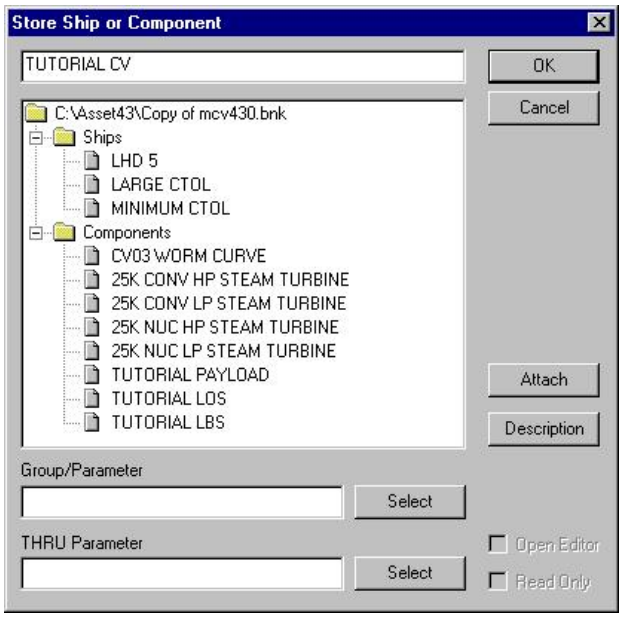
DESIGN MODE IND parameter. To view the help for this parameter, first highlight the parameter name, then select the **Index** button in the toolbar to call up the help file. Selecting the parameter with the right button on the mouse also accesses the Index. In the dialogue this brings up, select **What's This?** For this tutorial, we will be using the **ENDURANCE** design mode. Throughout the course of the tutorial, you will be entering specific parameter information. Use the Help Index to help understand any parameters with which you do not feel comfortable. The following table gives you the remainder of values for the MISSION group of parameters:

| | |
|---|---|
| ENDUR DISP IND | FULL LOAD |
| ENDUR DEF IND | USN |
| ENDURANCE | 8000 |
| MAX SPEED | |
| SUSTN SPEED IND | GIVEN |
| SUSTN SPEED | 26 |
| SUSTN SPEED POWER FRAC | 0.8 |
| ENDUR SPEED IND | GIVEN |
| ENDUR SPEED | 20 |
| AVIATION FACILITIES IND | MAJOR AVN |
| EMBARKED COMMANDER IND | FLAG CMDR |

These values are based on the initial anticipated requirements for this design as stated in Section 2. Note that although we have entered a desired maximum speed, the power of the ship will be based on the required sustained speed because the SUSTN SPEED IND is set to **GIVEN**. Using the Help Index will allow you to familiarize yourself with the effect of any of the parameters values on the development of the ASSET model.

Once you have entered the basic data for the Mission Group, exit the Editor using the **Close** button . Be sure to say yes to the query "Do you want to save changes to the current model?". While you are working in the editor, no changes are made to parameter values within the actual model. If you want the changes you have made to be saved in the active model you must exit the editor and answer yes to the dialogue. If you have made an error while working in the editor you can exit the editor without saving your changes. Saving changes from the editor only changes the current model in the active session, not the copy of the model in the databank. In order to change the databank, the model must be saved. If you have not already done so, store your ship to the databank at

this time (**Ship**, **Store**, type in a **ship name**, **OK** box or **File**, **Save As**, type in a **ship name**, **OK** box). A ship name can be up to 25 characters long (ex. TUTORIAL CV). Blanks are allowed.



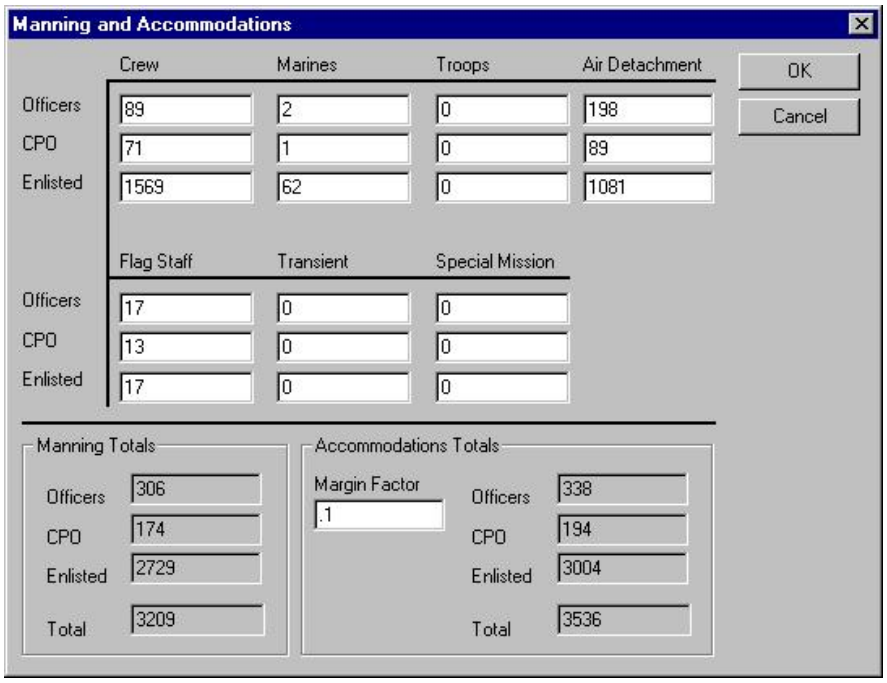

Before going any further, it is a good idea to insert a description of the ship into the current model. A table exists (SHIP COMMENT TBL) that is designated to contain a description of the model. The ship comment table should contain the type of ship, distinguishing characteristics, the designer's name, last date of modification, and anything else deemed pertinent.

On the *Command Line*, type **EDIT, SHIP COMMENT TBL**. This command also brings up the ASSET editor with at the specific parameter entered Type the ship description. The SHIP COMMENT TBL contains 25 rows. Each row can contain up to 70 characters. Below is an example of a ship comment table for the design in this tutorial.

| |
|---|
| TUTORIAL CARRIER |
| VERSION 4.3 -A |
| 22 JULY 1998 |

Once you have entered the data for the Ship Comment Table, **Close** the editor and save the input.

The next step is to enter the manning requirements for this design. Clicking on **Edit** on the menu bar, then selecting **Manning and Accommodations** opens the manning dialogue. In this dialogue, enter the manning numbers from Section 2 with a 10% (0.1) Margin Factor for the Accommodations.




Save the model to the databank at the end of this section by selecting **Ship, Modify** from the menu bar. The Save button in the toolbar will also save the model to the databank. You can exit ASSET, by selecting **File, Exit** from the menu bar.

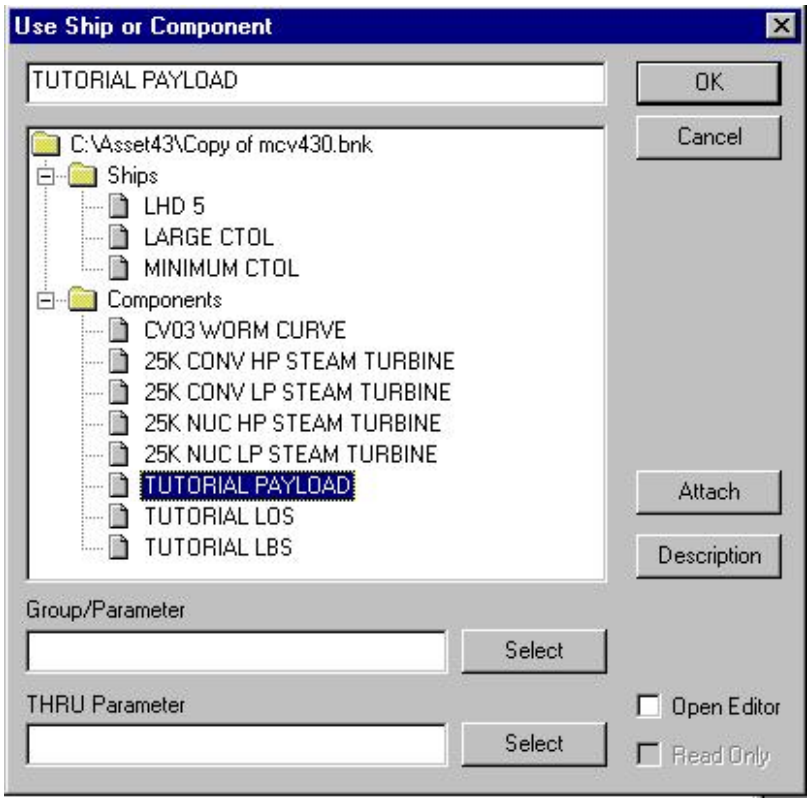
## Section 7.6 – PAYLOAD & ADJUSTMENTS

The next item to develop after defining the basic mission requirements is the ship's payload. Payload items, such as weapons and combat systems, must be input into ASSET. Most payload items require input of weight, arrangeable area, and electric load. All of the payload information needs to be entered in the PAYLOAD AND ADJUSTMENTS group. Payloads are discussed in more detail is Section 5.3. Since modeling payloads can take a sizable portion of time, this has already been done for you. A component named **TUTORIAL PAYLOAD** is stored in the data bank. Don't worry, you'll get a chance to edit this payload and see how it was created.

This component was created by taking portions of pre-existing models and compiling the needed information into **TUTORIAL PAYLOAD**. If no data exists for a particular payload item, the user would need to enter the information into the current model's PAYLOAD AND ADJUSTMENTS group. You will see exactly what data are needed in just a moment.

If you are not in ASSET, open ASSET now and select **Ship** then **Use** from the menu bar to get back to your tutorial carrier. The first thing you need to do is to make the component **TUTORIAL PAYLOAD** part of the current model. Do this by clicking on **Ship** from the menu bar and then selecting **Use**.

The *Use Ship or Component* dialogue box will appear. Select the **Components** folder, click on **TUTORIAL PAYLOAD** and select **OK**.




In the messages window you should see the command string USE, TUTORIAL PAYLOAD echoed. An executive program confirmation will be displayed, which should look like this:

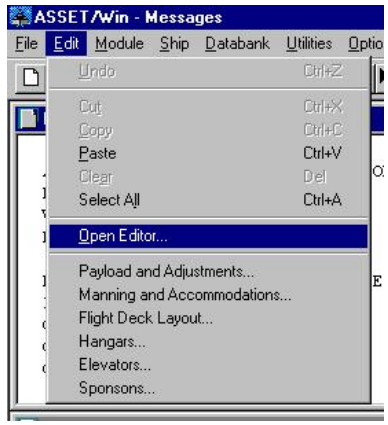
```
C,M>USE, TUTORIAL PAYLOAD
 ** CONFIRMATION - EXECUTIVE PROGRAM ** (C-COMPALLUSEOK-USE)
 ALL OF COMPONENT 'TUTORIAL PAYLOAD' HAS BEEN USED.
 C,M>
```

Just to recap, so far you have:

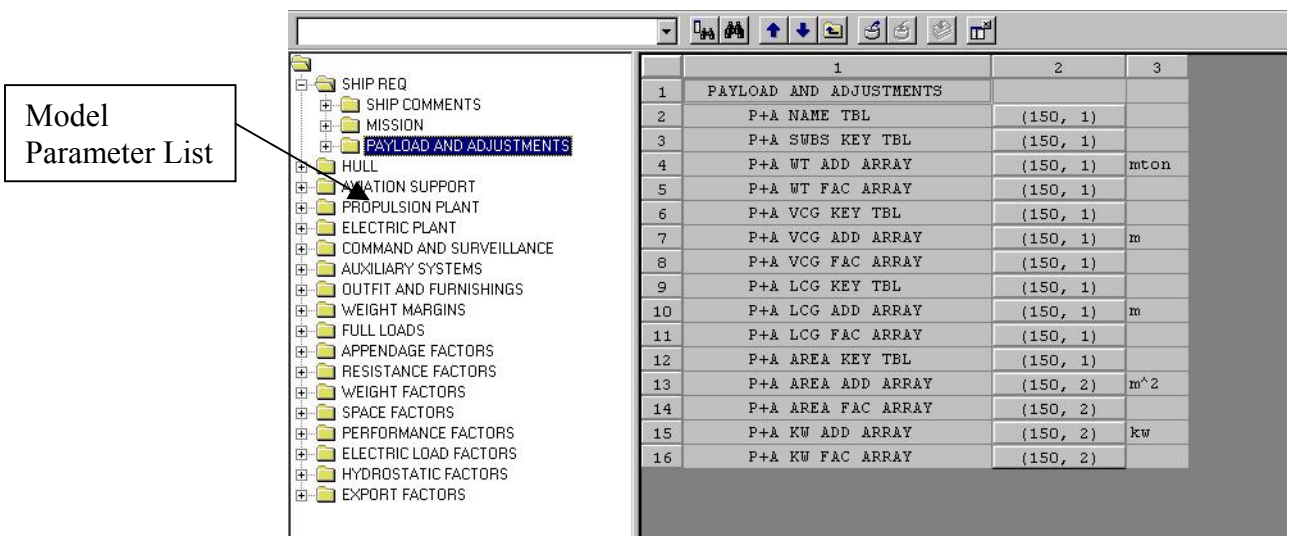
- Started the ASSET monohull, carrier program, MONOCV.
- Attached the data bank named mcv430.bnk.
- Used the component **TUTORIAL PAYLOAD** from the attached data bank and made it part of your current model.

The only information in the current model is the payload for your carrier design and the mission information entered in the previous section. You will enter all other required information as you work through the following sections of this tutorial. Before you move on, take a look at the payload information you brought into your current model. You can accomplish this three ways, either using the EDIT command or the Payload and Adjustment Dialogue. The EDIT command will put

you in the editor where you can view data in a spreadsheet format. The Payload and Adjustment Dialogue is a specialized dialogue for editing the PAYLOAD AND ADJUSTMENTS. To acquaint you with ASSET's editor, use the EDIT command. From the **Edit** menu (located in the menu bar), select **Open Editor**.



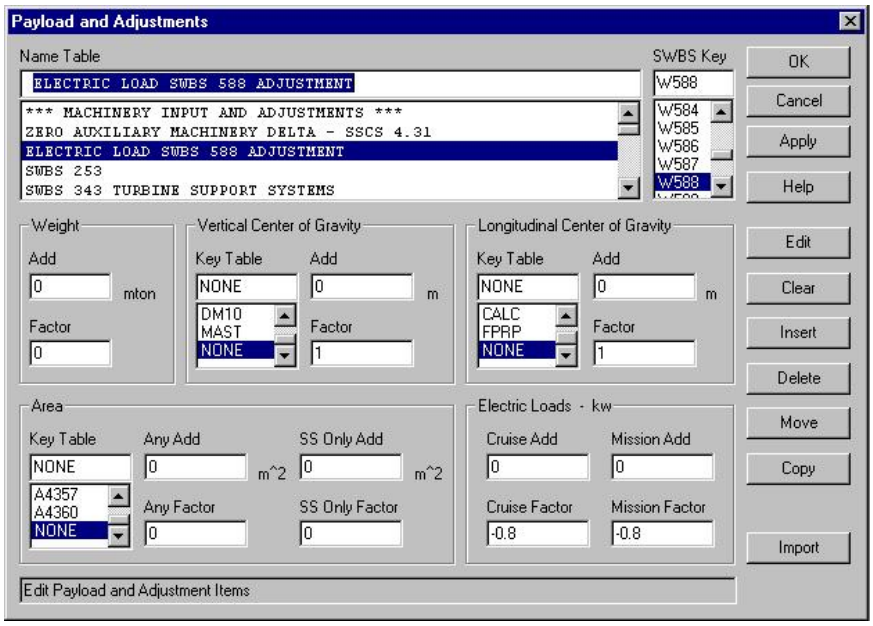

. Select **PAYLOAD AND ADJUSTMENTS** by clicking on the **SHIP REQ** folder, then the **PAYLOAD AND ADJUSTMENTS** folder. After selecting the **P+A NAME TBL** parameter, the Editor shows the Payload and Adjustments information in the current model.




To view the data, move the cursor to the desired array. There are twelve rows of information, each pertaining to a specific attribute of the payload. The first is the “P+A NAME TBL”. This table will give you the names of the payload items. Following the name table is the “P+A SWBS KEY TBL”, which contains the SWBS numbers for each item. The remaining parameters contain information about the Weight, VCG (Vertical Center of Gravity) location, Area requirement, and

Electric load (Kilowatts-KW) of each payload item. Each row of PAYLOAD AND ADJUSTMENT data relates to the same payload item. For example, all the information in row #1 of each PAYLOAD AND ADJUSTMENT table or array relates to the item described in row #1 of the P+A NAME TBL.

The Payload and Adjustments parameters are also available through a specific dialogue. Selecting **Edit, Payload and Adjustments** calls up the Payload and Adjustments dialogue.




AS you select each item in the name table, all of the associated parameters will be displayed in the dialogue. This dialogue can be used to view, enter or modify Payload & Adjustments data.

The PAYLOAD AND ADJUSTMENT parameters allow the designer to adjust the weight, required area and electric load algorithms within ASSET, as well as, input data for groups where algorithms do not exist. For each attribute (weight, area, or electric load) there are three values; a key, a factor, and an addition. (The electric loads use the P+A SWBS KEY TBL.) These three values are used to calculate the adjusted weight, area, or electric load following an equation of the form

$$\mathbf{Net = Calc + Fac*Calc + Add}$$

where;

| | | |
|---|---|---|
| Net | = | The final adjusted weight, area or electric load. |
| Calc | = | The value calculated by the internal ASSET algorithm. |
| Fac | = | The value in the P+A factor array (ie. P+A WT FAC ARRAY) |

Add = The value in the P+A add array (ie. P+A WT ADD ARRAY)

Tables 5-1 and 5-2 list the weight and area groups where ASSET does not have internal algorithms. For these groups, Calc = 0 and an appropriate value must be entered in the "Add" array. The parameters relating to VCGs (and LCGs) also use three values, a key, a factor, and an addition, but they are applied in a different manner. When inputting data to the PAYLOAD AND ADJUSTMENT parameters relating to VCGs and LCGs, you are specifying the location of the weight adjustment defined by the P+A WT FAC ARRAY and the P+A WT ADD ARRAY in the corresponding row. There is no way to directly adjust the VCG or LCG calculated by the internal ASSET algorithms. The three values are used to specify the VCG location of the weight increment following an equation of the form **VCG = Fac*Key + Add** where;

VCG = Vertical center of weight increment defined by the P+A WT FAC ARRAY and the P+A WT ADD ARRAY

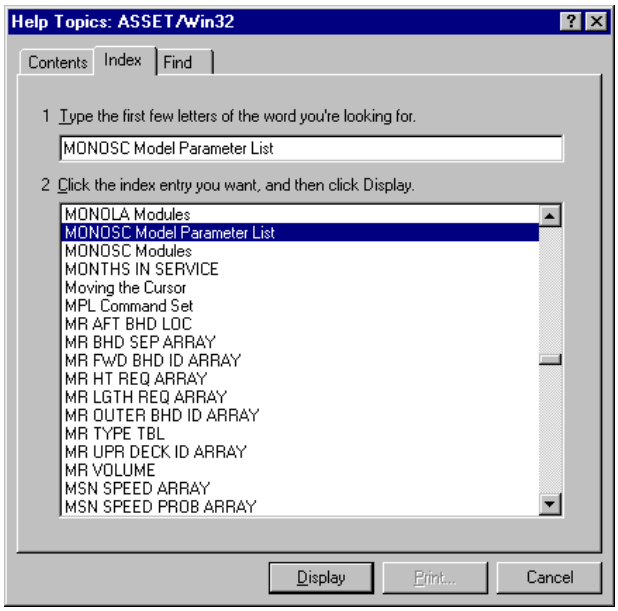
Fac = The value in the P+A factor array (ie. P+A VCG FAC ARRAY)

Key = One of the reference locations allowed in P+A VCG KEY TBL. (For example, D10, which is the hull depth at station 10.)

Add = The value in the P+A add array (ie. P+A VCG ADD ARRAY)

For example, let's say that payload item's VCG is to be located 1m above half the depth of the ship. In the VCG key table, the key would be D10, meaning the depth at station 10. The factor would then be 0.5 and the addition would be 1. This would yield the VCG location of item = 0.5(D10) + 1, which would place the VCG 1m above half the depth of the ship (measured from the baseline).

Move around the editor, looking at the parameters for the payload items. Familiarize yourself with editor commands and the arrays and tables in the PAYLOAD AND ADJUSTMENT group. Additional information can be found in the on-line help. To obtain information on a particular parameter, say the P+A AREA KEY TBL, click on **Help** in the menu bar and choose **Index**. A dialogue box appears, prompting you to **enter the parameter** for which you want it to search (Figure 6.3).



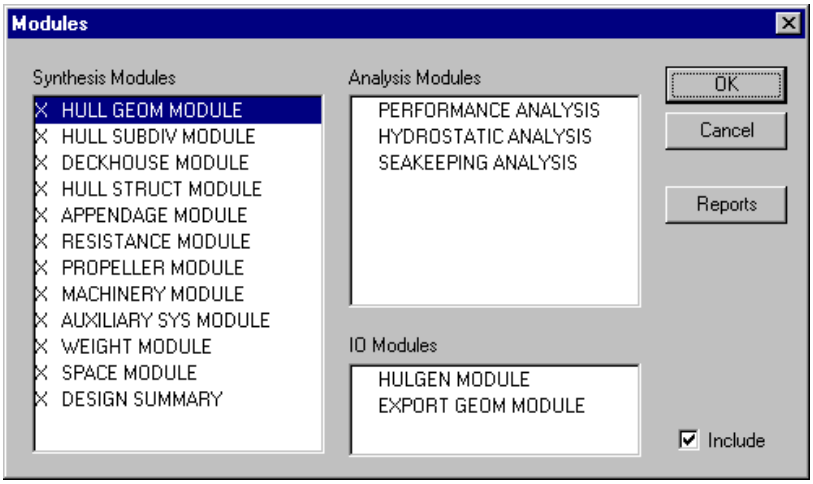

In the text entry box, type the letter p. Notice that the parameters beginning with the letter p appear. Click on P+A AREA KEY TABLE and click the **Display** command button. The information relating to the selected parameter is displayed. The search command is extremely useful and can be used to obtain the definition of any parameter to which ASSET prompts you to assign a value. You will be using the *Index* feature extensively during the remaining portions of this tutorial.

## Section 7.7 – HULL GEOMETRY MODULE

So far in the design, the inboard profile has been created, a preliminary length has been estimated, and the payload has been modeled in ASSET. With this accomplished, you are now ready to execute ASSET's computational modules. You will be running them one at a time in "prompt mode." Here, you will be entering design data as ASSET requires it to run the modules. The modules will be run in the order in which they are listed in the *Module* > *Run* dialogue box. When starting a new design the modules should always be run in this order. The first module to be executed is *Hull Geometry.*

*The Hull Geometry* module defines the geometry of the molded hull form via a set of offsets. In this module, you will allow ASSET to generate a hull form based on a few hull parameters.

To run the *Hull Geometry* module, under the **Module** menu choose **Run**. A dialogue box will appear with a listing of modules to run. Select **Hull Geometry** and click **OK**.




Notice that the command string RUN, HULL GEOM MODULE has been echoed in the command text box (and the *Messages* output window). You could have issued this command string instead of using the menu/dialogue box method.

After issuing the *Run* command, ASSET comes back with an error. The M in the C,M> prompt reminds us that we are working in metric units.

```
C,M>RUN, HULL GEOM MODULE
 ** FATAL ERROR - HULL GEOM MODULE ** (E-INVALIDDATA-HGMMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
     HULL OFFSETS IND
```

ASSET is telling you that it needs some of the current model's parameters to be filled with information before it can execute the module. In this case, ASSET needs input for the HULL OFFSETS IND. Instead of exiting you back to the main prompt, ASSET has put you into the editor in prompt mode "prompt mode." Here, ASSET prompts you for the needed information. By clicking the box for he parameter value in the editor ASSET will display all possible values for the parameter. Your job is to select the choice that is appropriate for your design. After determining your choice, simply select the corresponding menu item and press ENTER.

Since you are designing a carrier without a fully defined hull form, you will want ASSET to create the hull form for you. For HULL OFFSETS IND, select **GENERATE**. If you are unsure of the meaning of the parameter HULL OFFSETS IND, simply enter the **Help** menu, use the **Index,** click on the appropriate parameter from the list. From there, you can search for the definition. **You will need to use the on-line help often during the tutorial to obtain parameter definitions and their acceptable values.** After selecting **GENERATE**, upon execution of the program, ASSET will generate the shape of the hull. (If *Given* was chosen instead, you would have needed to enter the desired offsets.) **Close** the Editor and save your changes.

ASSET now runs the module again. This does not mean that you have entered all of the information that is needed. Since your input information will determine which way ASSET will proceed with its calculations, it cannot determine all of the parameters needed from the beginning. Based on how you have set the previous parameters, you have now given ASSET a path to follow.

ASSET now comes back with another error message; more parameters need user-definition. The first one is HULL DIM IND.

```
C,M>RUN, HULL GEOM MODULE
 ** FATAL ERROR - HULL GEOM MODULE ** (E-INVALIDDATA-HGMMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
     HULL DIM IND                        LBP
     PRISMATIC COEF                      MAX SECTION COEF
```

Use the on-line help to determine the meaning of HULL DIM IND and its acceptable values. Since we have the flight deck layout to give us an idea of the required beam and inboard profile to determine the required depth you want ASSET to only calculate the draft, select **T**. ASSET will calculate this value. The next parameter for you to enter is length (LBP). From the inboard profile, the length is **259**m.

The next two parameters are the prismatic and max section coefficients. ASSET requires you to enter values for these parameters. Using estimates based on previous designs, the value for the PRISMATIC COEF is **0.64** and for the MAX SECTION COEF is **0.98**

```
C,M>RUN, HULL GEOM MODULE
** FATAL ERROR - HULL GEOM MODULE ** (E-INVALIDDATA-HGMMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
     BEAM                              DEPTH STA 10
```

Again, ASSET asks for more information. The BEAM and DEPTH STA 10 parameters need values. Use on-line help to clarify these parameters. Once you are familiar with them, assign the value **37** for BEAM and **26.6** for DEPTH STA 10.

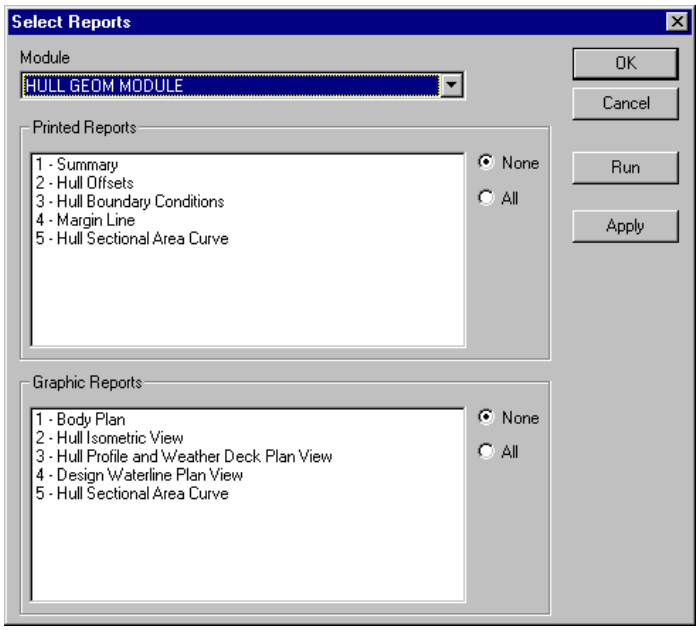
Run the Hull Geometry module again.

```
C,M>RUN, HULL GEOM MODULE
 ** WARNING - HULL GEOM MODULE ** (W-DEFAULTVALUES-HGMMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     MIN BEAM                          MAX BEAM
     STABILITY IND                     FUEL SYS TYPE IND
     GMT/B REQ                         FREE SURF COR
     SERV LIFE KG ALW                  BULWARK HT
     HULL FLARE ANGLE                  RAISED DECK HT
     HULL BC IND                       HULL STA IND
     OFFSETS DEF ARRAY                 MARGIN LINE IND
     MIN FREEBOARD MARGIN

 ** WARNING - HULL GEOM MODULE ** (W-TEMPVALUES-HGMMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
     AREA BEAM                         APPENDAGE DISP ARRAY
     APPENDAGE CB ARRAY                FULL LOAD WT
     FULL LOAD CG ARRAY

 ** WARNING - HULL GEOM MODULE ** (W-HULPARXLIMITS4BC-HGMCOM)
 HULL FORM PARAMETERS ARE NOT WITHIN RECOMMENDED LIMITS FOR
 GENERATION OF BOUNDARY CONDITIONS.
   QUANTITY   LOWER LIMIT   UPPER LIMIT    VALUE
   --------   -----------   -----------   ------
   LBP, M        182.88       320.04       259.00
   CX              .800         .980         .980
   CP              .570         .660         .640
   B/T            3.250        4.750        7.053

 C,M>
```

This time, ASSET does not prompt you for more information. Instead, the module runs completely through; however, warnings appear. Notice the list of parameters that were provided default and temporary values. See Section 3.4.2.3 for an explanation of temporary and default values.

It is good practice to review what parameters were provided default values. In some instances, you might be able to set the parameter to a user-known value. In other cases you might want to just check the parameter's value to make sure ASSET has not defaulted to an inappropriate value. Parameters set to temporary values are not a concern at this point, because these values are not saved to the Current Model. These parameters will be set by the appropriate module when that module is run.

At this point, you have completed the first run of the hull geometry module. This is a good point to modify your ship. Use the command **SHIP, MODIFY** from the menus. Before you proceed to the next module, look at the printed and graphic reports generated by this module. If no output reports are selected, and a module is run, the module will generate Printed Report #1 (which is a summary of the data pertinent to the module). To view other printed reports and graphic reports, you need to set the output reports to be generated. Click on **Module** on the title bar, then **Run**. From the *Run Module* dialogue box, you are able to select output reports. Press the **Reports** command button. A dialogue box appears.

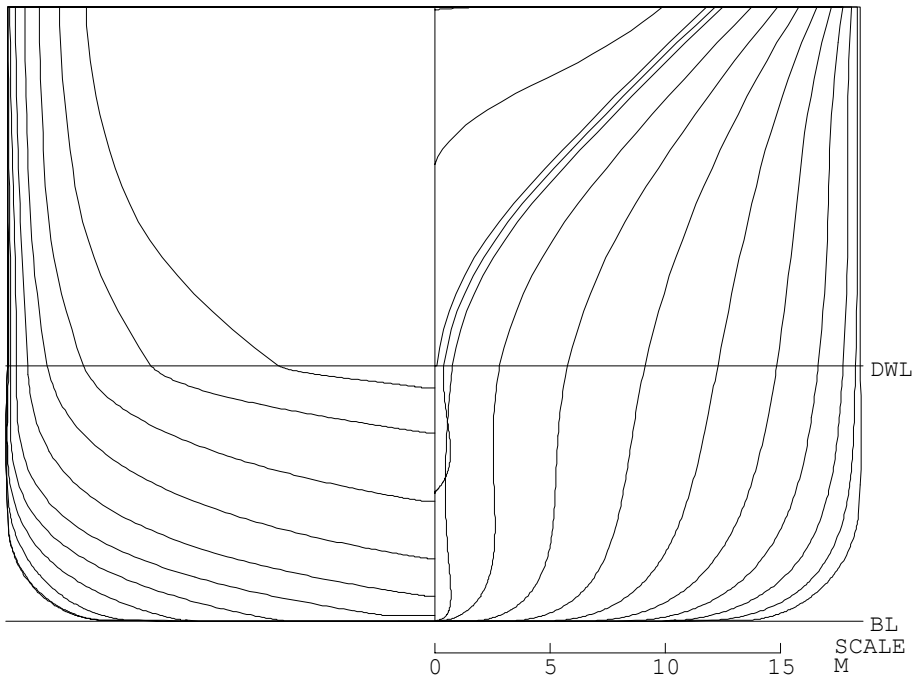


From the drop-down list box, select **HULL GEOM MODULE**. A list of reports will appear in the list boxes as shown in the above figure. Select as many as you like. By holding down the control key while clicking on the desired reports, you will be able to select more than one. If you hold the shift key while selecting two reports will give you those two reports and all reports in between. After selecting the reports, press **OK**. From the *Run Module* dialog box, select **HULL GEOM MODULE** and press **OK**. Alternately, pressing the *Run* button in the *Select Output Reports* dialog box will set the reports and run the module**. If you selected more than one graphic report, you need to click the mouse button (or hit any key) to proceed to the next report or to get back to the "READY" status (shown in the lower right of the status bar) vice "GRAPHICS" status**. When using the Graphic reports you must review all of the graphic reports from a module before you do anything else within ASSET. Any report can be printed by using the *Print* command located in the *File* menu of the menu bar.

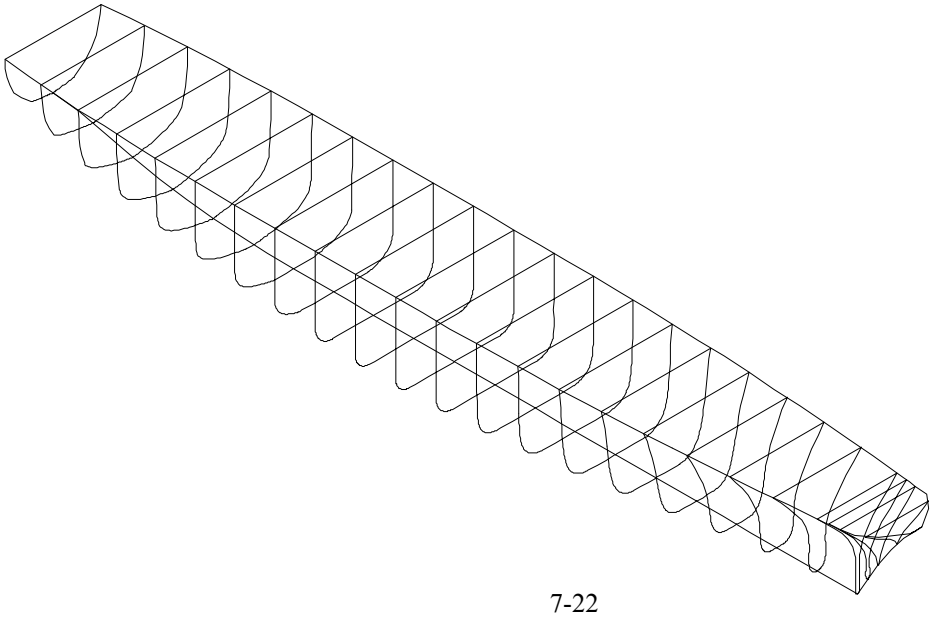
**Note**: The *Printed Reports* and *Messages* windows do not clear themselves. Later in this tutorial, if you print the contents of the *Printed Reports* window, you will print everything that has been sent to that window during the entire ASSET session--not just the reports you have selected for the current module with which you are working. To avoid this, *clear the window* before generating any new printed reports. Do this by selecting **Edit** from the menu bar, followed by the **Select All**, then select the **Clear** command from the *Edit* menu.

Following are the summary printed report, and the body plan and the hull isometric view graphic reports. Notice that the draft is lower than might be expected for the depth of the hull. This is due to the weight estimate generated by the Hull Module. As the design is refined

ASSET/MONOCV VERSION 4.3.0 - HULL GEOM MODULE - 8/10/98 15:43.28
GRAPHIC DISPLAY NO. 1 - BODY PLAN




ASSET/MONOCV VERSION 4.3.0 - HULL GEOM MODULE - 8/10/98 15:41.34
GRAPHIC DISPLAY NO. 2 - HULL ISOMETRIC VIEW



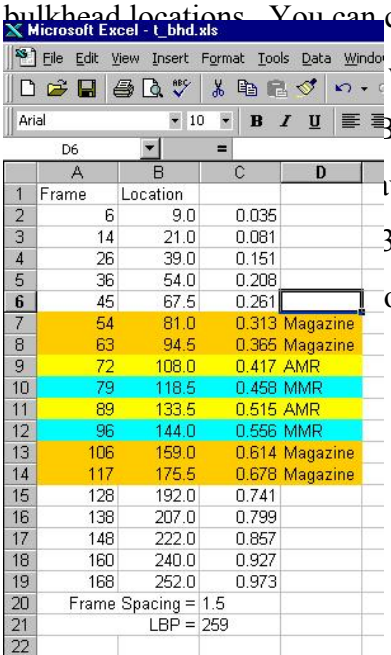
```
ASSET/MONOCV VERSION 4.3.0 - HULL GEOM MODULE -   8/ 5/98 13:46.52

 PRINTED REPORT NO.  1 - HULL GEOMETRY SUMMARY

 HULL OFFSETS IND-GENERATE            MIN BEAM, M                 9.14
 HULL DIM IND-T                       MAX BEAM, M                45.72
 MARGIN LINE IND-CALC                 HULL FLARE ANGLE, DEG        .00
 HULL STA IND-OPTIMUM                 FORWARD BULWARK, M          1.22
 HULL BC IND-CV
 FAST SHIP PARENT IND-

                  HULL PRINCIPAL DIMENSIONS (ON DWL)
                  ==================================
 LBP, M                     259.00   PRISMATIC COEF               .640
 HULL LOA, M                271.07   MAX SECTION COEF             .980
 BEAM, M                     37.00   WATERPLANE COEF              .773
 BEAM @ WEATHER DECK, M      37.00   LCB/LBP                      .520
 DRAFT, M                     5.25   HALF SIDING WIDTH, M         .30

 DEPTH STA 0, M              26.66   BOT RAKE, M                  .00
 DEPTH STA 3, M              26.66   RAISED DECK HT, M            .00
 DEPTH STA 10, M             26.66   RAISED DECK FWD LIM, STA
 DEPTH STA 20, M             26.66   RAISED DECK AFT LIM, STA
 FREEBOARD @ STA 3, M        22.63   BARE HULL DISPL, MTON    32325.53

 STABILITY BEAM, M           32.38   AREA BEAM, M                25.90

       BARE HULL DATA ON LWL                STABILITY DATA ON LWL
       =====================                =====================
 LGTH ON WL, M              259.00   KB, M                        2.87
 BEAM, M                     37.00   BMT,  M                     21.43
 DRAFT, M                     5.24   KG,  M                      16.00
 FREEBOARD @ STA 3, M        22.64   FREE SURF COR, M              .00
 PRISMATIC COEF               .639   SERV LIFE KG ALW, M           .00
 MAX SECTION COEF             .981
 WATERPLANE COEF              .772   GMT, M                       8.31
 WATERPLANE AREA, M2       7402.63   GML, M                     856.40
 WETTED SURFACE, M2        8772.66   GMT/B AVAIL                  .225
                                     GMT/B REQ                    .100
 BARE HULL DISPL, MTON    32344.06
 APPENDAGE DISPL, MTON      696.34
 FULL LOAD WT, MTON       33040.31
```

## Section 7.8 – HULL SUBDIVISION MODULE

The next module in the sequence is Hull Subdivision. This module defines the internal hull subdivisions, including decks, platforms, transverse bulkheads, longitudinal bulkheads, large object spaces and inner bottom.

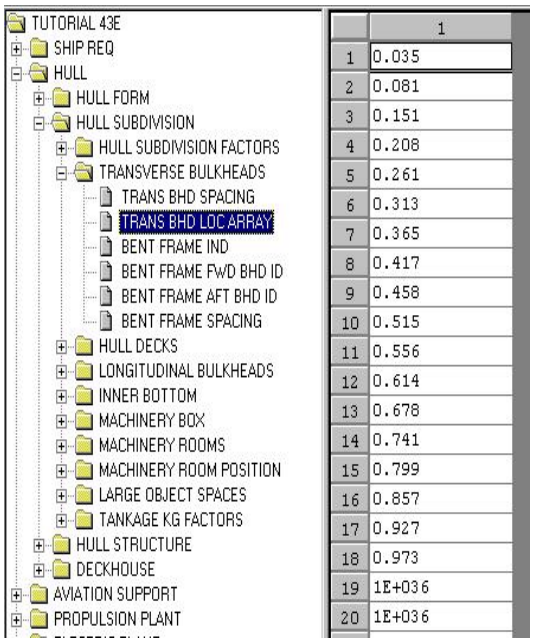
Because we know more about the deck and bulkhead arrangement we need for our carrier design, based on our preliminary inboard profile, we will enter much of this information before we run the **Hull Subdivision Module**. Use the menu bar to open the editor (**Edit, Open Editor**), then use the Model Parameter List (MPL) structure on the left side of the editor to navigate to the HULL SUBDIVISION Parameters. You can do this by selecting the **HULL** folder, then the **HULL SUBDIVISION** folder. The first Parameter is HULL SUBDIV IND. You can use the Help Index to get a Description of this Parameter. We will be providing the Subdivision information to ASSET rather than letting ASSET calculate it for us, so set this Parameter to **GIVEN**.

The next Parameter we will use is in the TRANSVERSE BULKHEADS folder. The TRANS BHD LOC ARRAY defines the location of each transverse bulkhead as a percentage of the distance between forward and aft perpendiculars. Typically, the naval architect thinks of the bulkhead spacing more in terms of a distance between bulkheads. In order to translate this into the numbers that ASSET is looking for, we use Excel (or other similar program) to calculate the location of each of the transverse bulkheads. In Excel, simply create a new file with the locations of the bulkheads expressed in meters from the FP in one column. Divide this column by the LBP to get the ASSET values for the bulkhead locations. You can copy and paste the calculated values from Excel to the TRANS BHD




| | A | B | C | D |
|---|---|---|---|---|
| 1 | Frame | Location | | |
| 2 | 6 | 9.0 | 0.035 | |
| 3 | 14 | 21.0 | 0.081 | |
| 4 | 26 | 39.0 | 0.151 | |
| 5 | 36 | 54.0 | 0.208 | |
| 6 | 45 | 67.5 | 0.261 | |
| 7 | 54 | 81.0 | 0.313 | Magazine |
| 8 | 63 | 94.5 | 0.365 | Magazine |
| 9 | 72 | 108.0 | 0.417 | AMR |
| 10 | 79 | 118.5 | 0.458 | MMR |
| 11 | 89 | 133.5 | 0.515 | AMR |
| 12 | 96 | 144.0 | 0.556 | MMR |
| 13 | 106 | 159.0 | 0.614 | Magazine |
| 14 | 117 | 175.5 | 0.678 | Magazine |
| 15 | 128 | 192.0 | 0.741 | |
| 16 | 138 | 207.0 | 0.799 | |
| 17 | 148 | 222.0 | 0.857 | |
| 18 | 160 | 240.0 | 0.927 | |
| 19 | 168 | 252.0 | 0.973 | |
| 20 | Frame Spacing = | | 1.5 | |
| 21 | | LBP = | 259 | |
| 22 | | | | |

will probably want to save the Excel file in a convenient location so that BP changes and you don't want all of the transverse bulkhead spacing to ve transverse bulkheads (based on the Inboard Profile) at 9, 21, 39, 54, 3.5, 144, 159, 175.5, 192, 207, 222, 240 & 252m. Use a spreadsheet ocations, then cut and paste the results to the TRANS BHD LOC




The next Subdivision Parameter we will look at is the HULL DECK LOC ARRAY that gives the height of each deck. The HULL DECK SHEER ARRAY and HULL DECK TYPE TBL are associated with the HULL DECK LOC ARRAY and serve to provide ASSET with additional data about the decks. The HULL DECK SHEER ARRAY tells ASSET whether each deck has sheer – in our design none of the decks will have sheer. The HULL DECK TYPE TBL gives ASSET information about the type of deck each deck is. Again use the Help Index to get further explanation of the meaning of any Parameter. The following table gives the values for these three Parameter Array – enter these values into your ASSET model.

| HULL DECK LOC ARRAY | HULL DECK SHEER ARRAY | HULL DECK TYPE TBL |
|---|---|---|
| 26.6 | 1 | CONTINUOUS |
| 23.6 | 0 | CONTINUOUS |
| 20.4 | 0 | CONTINUOUS |
| 17.2 | 0 | CONTINUOUS |
| 13.75 | 0 | CONTINUOUS |
| 10.3 | 0 | CONTINUOUS |
| 7.3 | 0 | PLATFORM |
| 4.25 | 0 | PLATFORM |
| 1.22 | 0 | INNER BOT |

Note that we are only entering the information for decks within the hull, not for those in the deckhouse or island.

Defining the LONGITUDINAL BULKHEADS is the next step in defining the Hull Subdivision. The LONGITUDINAL BULKHEADS are defined in ASSET by a series of arrays. The LONG BHD X LOC ID ARRAY defines the fore and aft extents of the bulkhead by locating the transverse bulkheads at the fore and aft end. The LONG BHD Y LOC ARRAY defines the transverse location of the longitudinal bulkhead by specifying distances off the centerline of the ship. The LONG BHD DECK ID ARRAY defines the top and bottom edges of the bulkhead by defining the decks between which the bulkhead lies. The LONG BHD TYPE TBL determines whether the bulkhead is planar, or follows the contour of the shell. Finally, the LONG BHD STRUCT EFFCT TBL defines if the bulkhead will be used in the hull structural strength calculations. In the ASSET Editor select the **LONGITUDINAL BULKHEADS** Folder, then the **LONG BHD X LOC ID ARRAY** Parameter. This will open a spreadsheet like form that will allow you to enter all of the values for each longitudinal bulkhead. Enter these longitudinal bulkheads into the Arrays with the following values:

| X Location | | Y Location | | | Deck ID | | Type | Struct |
|---|---|---|---|---|---|---|---|---|
| 5 | 12 | 11.42 | 11.42 | 15.08 | 1 | 4 | PLANAR | YES |
| 5 | 12 | -11.42 | -11.42 | -15.08 | 1 | 4 | PLANAR | YES |
| 12 | 18 | 15.08 | 15.08 | 12.49 | 1 | 4 | PLANAR | YES |
| 12 | 18 | -15.08 | -15.08 | -12.49 | 1 | 4 | PLANAR | YES |
| 5 | 12 | 9.5 | 11.42 | 12.7 | 4 | 9 | PLANAR | YES |
| 5 | 12 | -9.5 | -11.42 | -12.7 | 4 | 9 | PLANAR | YES |
| 12 | 18 | 12.7 | 15.08 | 10.5 | 4 | 9 | PLANAR | YES |
| 12 | 18 | -12.7 | -15.08 | -10.5 | 4 | 9 | PLANAR | YES |

The next step is to define the INNER BOTTOM Parameters. The first of these is CVK HT, which defines the height of the center vertical keel, set this to **1.22**. The next parameter we will use is INNER BOT DECK ID. This parameter tells ASSET which deck in the ship is considered the inner bottom. For our design this will be **9.** The INNER BOT X LOC ARRAY defines the fore and aft extents of the inner bottom. For our design, the Inner bottom will run from Frame 21 to Frame 210. The values of this parameter are similar to the values for the transverse bulkheads in that they are defined as a fraction of the distance between FP and AP. From the Transverse Bulkhead table we can see that Frames 21 & 207ould be entered as **0.081**& **0.799.** Enter these values in the INNER BOT X LOC ARRAY.

The next step is to define the MACHINERY ROOMS. The machinery rooms are defined in an array with several parameters and we will use our notional inboard profile to define the values for our machinery rooms. The first parameter is the MR TYPE TBL, which defines the function of each Machinery Room. The MR FWD BHD ID ARRAY specifies the forward bulkhead for each space. The MR UPR DECK ID ARRAY and MR LOWER DECK ID ARRAY give the top and bottom decks for the machinery rooms. The MR BHD SEP ARRAY defines the number of transverse bulkheads between machinery rooms. Because we have set the HULL SUBDIV IND to GIVEN, ASSET will fill in this information for us based on the rest of the MACHINERY ROOM data. Finally, the MR OUTER BHD ID ARRAY defines the port and starboard limits for the machinery spaces. The following table gives the values for the machinery room parameters.

| MR TYPE | FWD BHD | UPPER DK | LOWER DK | BHD SEP | OUTER BHD | |
|---|---|---|---|---|---|---|
| AMR | 8 | 6 | 9 | Default | 6 | 5 |
| MMR | 9 | 6 | 9 | Default | 6 | 5 |
| AMR | 10 | 6 | 9 | Default | 6 | 5 |
| MMR | 11 | 6 | 9 | Default | 6 | 5 |

After entering the Machinery Room data, **CLOSE** the Editor. Be sure to answer **Yes** when asked if you want save your changes.

Instead of running the Hull Subdivision module by using the pull-down menus, type the corresponding command string at the command prompt. Before we run the module, we will turn the graphic reports on by typing SET,GRAPHICS,HULL SUBDIV MODULE,ALL at the command prompt. The full command string to run the module is RUN, HULL SUBDIV MODULE but you can abbreviate the command to something shorter, like RUN,HULLSUBMOD or RUN,HULLSUB or even RU,SUB. ASSET will accept any properly spelled combination of word fragments describing the full command string. If you enter a command string that is not unique to a single full command string, like RUN, HULL, you will get back the following:

```
C,M>run,hull
 THE ABBREVIATION 'HULL' MATCHED EACH OF THE
 PHRASES LISTED BELOW. PLEASE ENTER PHRASE NUMBER OR NEW PHRASE.
   1 HULL GEOM MODULE                 3 HULL STRUCT MODULE
   2 HULL SUBDIV MODULE
 I>  2
 COMMAND STRING IS:
   RUN,HULL SUBDIV MODULE
```

ASSET lists all the phrases that match with your abbreviated command string. Simply choose the desired phrase by entering the corresponding number - in this case **2**.

Note: When entering an abbreviation in an ASSET command, using the first letter of each word is usually a good choice. The algorithm in ASSET can usually determine the full command. The verb sections of ASSET commands are only single words (i.e. set, show, run, etc.). Therefore, two letters should be entered to discriminate between verbs starting with the same letter.

The Hull Subdivision module should run successfully and provide all of the graphic reports. Take time to go through the Graphic Reports and notice the locations of the decks, bulkheads and spaces we have defined in this section. After you have finished the Graphic Reports, the following warnings.

```
** WARNING - HULL SUBDIV MODULE ** (W-DEFAULTVALUES-HSDMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     HULL DECK SHEER ARRAY              INNER BOT X LOC ARRAY
     SHIP TANKAGE KG ADD                SHIP TANKAGE KG FAC

 ** WARNING - HULL SUBDIV MODULE ** (W-TEMPVALUES-HSDMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
     MAIN DECK HT                       MR LGTH REQ ARRAY
     MR HT REQ ARRAY                    TANKAGE VOL REQ
     SHAFT SUPPORT TYPE IND

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRLGTH-TBHPOS)
 REQUIRED LENGTH EXCEEDS AVAILABLE LENGTH FOR MACHINERY ROOM NO. 1.

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRLGTH-TBHPOS)
 REQUIRED LENGTH EXCEEDS AVAILABLE LENGTH FOR MACHINERY ROOM NO. 2.

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRLGTH-TBHPOS)
 REQUIRED LENGTH EXCEEDS AVAILABLE LENGTH FOR MACHINERY ROOM NO. 3.

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRLGTH-TBHPOS)
 REQUIRED LENGTH EXCEEDS AVAILABLE LENGTH FOR MACHINERY ROOM NO. 4.

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRHT-ADECKS)
 REQUIRED HEIGHT EXCEEDS AVAILABLE HEIGHT FOR MACHINERY ROOM NO. 1.

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRHT-ADECKS)
 REQUIRED HEIGHT EXCEEDS AVAILABLE HEIGHT FOR MACHINERY ROOM NO. 2.

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRHT-ADECKS)
 REQUIRED HEIGHT EXCEEDS AVAILABLE HEIGHT FOR MACHINERY ROOM NO. 3.

 ** WARNING - HULL SUBDIV MODULE ** (W-INSUFFMRHT-ADECKS)
 REQUIRED HEIGHT EXCEEDS AVAILABLE HEIGHT FOR MACHINERY ROOM NO. 4.
```

Pay attention to any parameters that ASSET sets default values for, the values chosen may not be appropriate for your particular design. The temporary values are simply an estimation by ASSET until more accurate information is available in later modules. The warnings about the Machinery room sizes are not a big concern because we have not run the Machinery Module yet. This is a good time to save your model to the databank (**Ship, Modify**)

The next step in the Hull Subdivision module is to define the LARGE OBJECT SPACES. These spaces include the Hanger, Magazines, Side Protective Systems etc. Open the Editor (**Edit, Open Editor**) and navigate through the Model Parameter List to the Large Object Spaces (HULL, HULL SUBDIVISION, LARGE OBJECT SPACES). The large object spaces definition is similar to the Machinery Rooms with a few additional parameters. In addition to the forward bulkhead parameter there is a LG OBJ AFT BHD ID ARRAY to define the aft end of any Large Object Space. The upper and lower decks are defined in the same manner, but there is now also a parameter LG OBJ LOWER DECK TYPE TBL that defines whether the bottom deck of the Large Object Space is local or continuous throughout the ship. The outer bulkhead are defined the in the same way as the Machinery Rooms'. Finally there is a parameter LG OBJ SPACE TYPE TABLE defining the type of each Large Object Space. The following table gives the parameter values for some of the Large Object Spaces in our design:

| Fwd Bhd | Aft Bhd | Upr Dk | Lwr Dk | Lwr Dk Ty | Outer Bhd | | Tankage | Space Typ |
|---|---|---|---|---|---|---|---|---|
| 6 | 12 | 2 | 4 | CONTINUOUS | 2 | 1 | 0 | HANGAR |
| 12 | 16 | 2 | 4 | CONTINUOUS | 4 | 3 | 0 | HANGAR |
| 1 | 2 | 5 | 1.00E+36 | CONTINUOUS | 1.00E+36 | 1.00E+36 | 0 | CHAIN LCKR |
| 6 | 7 | 7 | 8 | CONTINUOUS | 6 | 5 | 0 | MAGAZINE |
| 6 | 7 | 6 | 7 | CONTINUOUS | 6 | 5 | 0 | MAGAZINE |
| 5 | 6 | 5 | 9 | CONTINUOUS | 1.00E+36 | 6 | 0 | SPS |
| 6 | 7 | 5 | 9 | CONTINUOUS | 1.00E+36 | 6 | 0 | SPS |

The value of 1.00E+36 indicates a default value to ASSET and in this case will indicate to use the shell as the space boundary. The Tankage parameter indicates the percentage of volume that can be used for tanks. The Aviation Support module will set the value for this for SPS and BPS spaces. Once you have entered these values in the Editor, close the editor and save the changes. Run the Hull Subdivision module again (**Module, Run, HULL SUBDIV MODULE**). Pay attention to the graphic reports to see where the Large object spaces have cut through decks and bulkheads (especially the Hanger and Chain Locker).

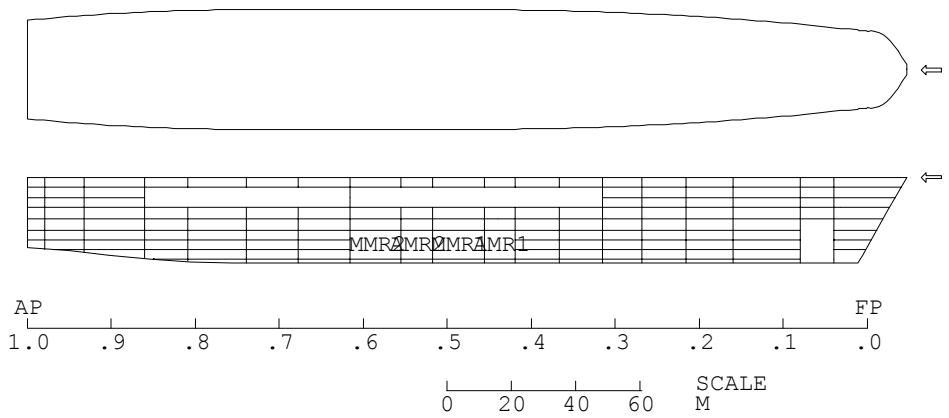
In order to speed up the development of the tutorial model a few components have stored in the databank. Components are simply a piece of an ASSET model which been saved separately in the databank. The first component we will read in adds some longitudinal bulkheads. To read it in select

**Ship**, then **Use** from the Menu Bar. This brings up the Use Ship or Component Dialogue. Select the **TUTORIAL LBS** component and select **Ok**. The next component we will use fills in all of the large object spaces. Repeat the previous steps, but select the **TUTORIAL LOS** component. After reading these components you can look over the parameters that have been read in using the Editor. Run the HULL SUBDIV module again so that all of the new parameters take effect.

The first run of the Hull Subdivision module is now complete. Save the model to the databank. Following are the summary printed report and graphic report #1.

ASSET/MONOCV VERSION 4.3.0 - HULL SUBDIV MODULE - 8/11/98 9:15.40
GRAPHIC DISPLAY NO. 1 - HULL DECKS AND PLATFORMS
03 LEVEL
(DECK NO. 1)

| | |
|---|---|
| DECK AREA, M2 | 9086.5 |
| TOTAL SHIP ARR AREA, M2 | 49109.2 |
| TOTAL HULL VOLUME, M3 | 204857. |




ASSET/MONOCV VERSION 4.3.0 - HULL SUBDIV MODULE - 8/ 7/98 14:20.31

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN INNER BOT DECK ID- 9

| | | | |
|---|---|---|---|
| LBP, M | 259.00 | HULL AVG DECK HT, M | 3.54 |
| DEPTH STA 10, M | 26.66 | | |
| TOTAL HULL VOLUME, M3 | 204857. | NO. OF DECKS | 9 |
| | | NO. OF TRANS BHDS | 18 |
| MR VOLUME, M3 | 11447. | NO. OF LONG BHDS | 12 |
| OP TANKAGE ALLOCATED, M3 | 9719. | NO. OF MACHY RMS | 4 |
| OP TANKAGE UTILIZED, M3 | 9719. | NO. OF LARGE OBJECT SPACES | 35 |
| OP TANKAGE REQ, M3 | 8861. | | |
| SHAFT ALLEY VOL, M3 | 0. | | |
| LARGE OBJECT VOL, M3 | 44067. | | |
| HULL ARR AREA AVAIL, M2 | 50506.4 | | |

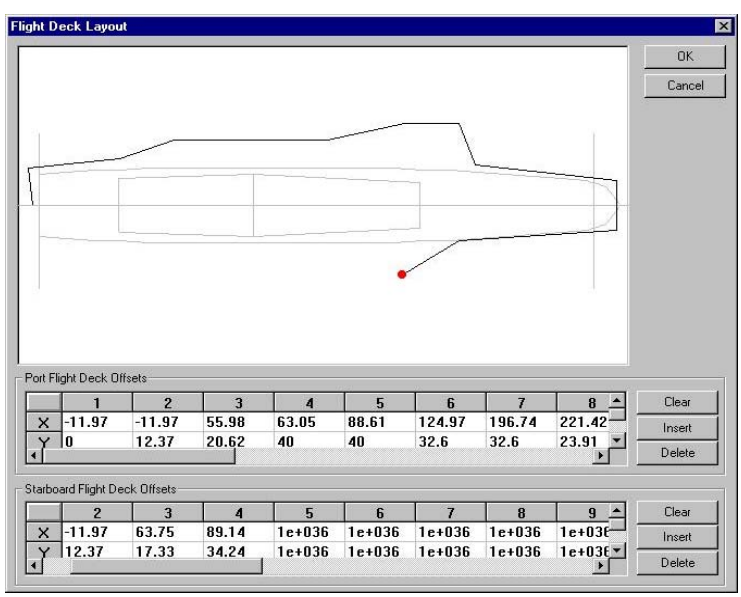
# Section 7.9 – AVIATION SUPPORT MODULE

With the hull form and hull subdivision defined, we are now ready to turn our attention to the Aviation Facilities of the Carrier design. The design of the flight deck and associated systems will be based on the Flight Deck arrangement created in General Layout definition. The flight deck can be laid out using any CAD package or even by hand. ASSET will not reads in the flight deck model directly, rather the values for the design of the flight deck will be entered using some specialized dialogues.

The First of these dialogues we will use will be for the Flight Deck Layout. To open this dialogue, select **Edit** then **Flight Deck Layout** from the menu bar. This form enters data into the PORT FLT DK OFFSET ARRAY and STBD FLT DK OFFSET ARRAY. These arrays define the perimeter of the flight deck with dimensions from the forward perpendicular and ship Centerline. Enter the following data into the Flight Deck Layout Form.

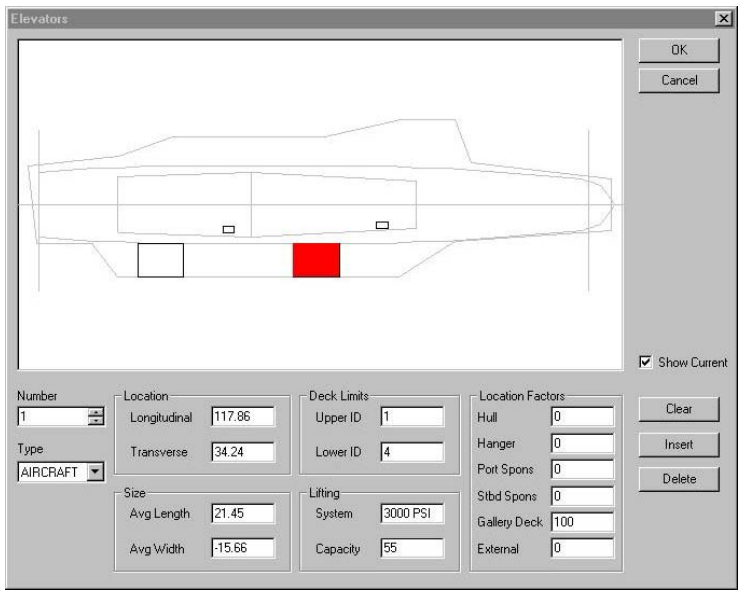
| | Port Flight Deck Offsets | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| X | -12 | -12 | 56 | 63 | 88.6 | 125 | 197 | 221.5 | 264.75 | 262.62 |
| Y | 0 | 12.5 | 20.6 | 40 | 40 | 32.6 | 32.6 | 24 | 19 | 0 |
| | Starboard Flight Deck Offsets | | | | | | | | | |
| X | -12 | -12 | 63.75 | 89 | 222 | 235 | 260.5 | 262.62 | | |
| Y | 0 | 12.5 | 17.3 | 34.25 | 34.25 | 18.2 | 18.2 | 0 | | |

If you enter the x and y coordinates for each point before moving onto the next point you will see the Flight deck get "built" in the graphic section of the form. The negative x values indicate that the point is forward of FP. Select **OK** to exit the dialogue.



The Elevator Dialogue, which we use to define the location and types of elevators, is the next step. Select **Edit** then **Elevators** to open the Elevator Editor. This form enters all of the parameter values to define Elevators within MONOCV. Use the ASSET Help index to get help on any parameters that you do not understand. The following table gives the elevator values for our design.

| | Type | Long | Trans | Len | Width | Upr | Lwr | System | Cap | Location Factors | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AIRCRAFT | 120 | 34.24 | 21.45 | -15.66 | 1 | 4 | 3000 PSI | 55 | 0 | 0 | 0 | 0 | 100 | 0 |
| 2 | AIRCRAFT | 192.5 | 34.24 | 21.45 | -15.66 | 1 | 4 | 3000 PSI | 55 | 0 | 0 | 0 | 0 | 100 | 0 |
| 3 | WEAPON | 94.87 | 8.26 | 5.79 | 2.89 | 1 | 4 | | | 0 | 100 | 0 | 0 | 0 | 0 |
| 4 | WEAPON | 167.04 | 10.3 | 5.79 | 2.89 | 1 | 4 | | | 0 | 100 | 0 | 0 | 0 | 0 |



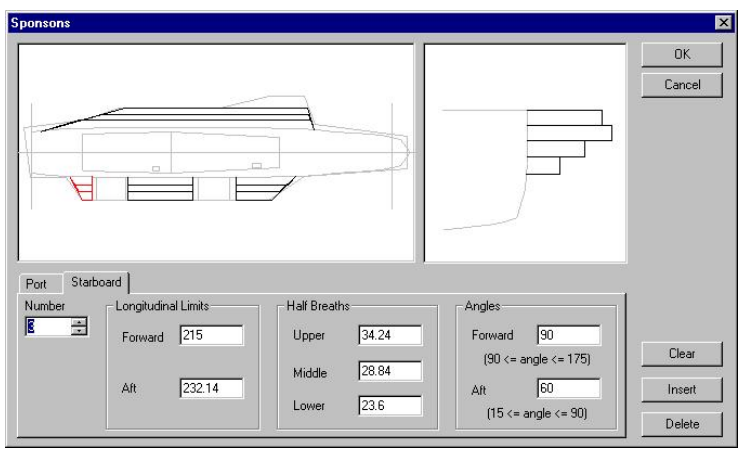

When entering values in this form, enter all of the values for an elevator, then select the next higher elevator number (using the up arrow in the Number box). This enters the data for the elevator. The negative width values signify that the width of the elevator is toward the centerline from the locating point of the elevator. Notice that in the graphics section of the editors the specific feature being currently edited will appear in red, any other similar features (in this case any other elevators) will be in black and all other flight features will be in gray. Select **OK** to exit the dialogue.

The final dialogue for flight deck we will use is the sponson dialogue. To open the Sponson Editor, select **Edit** then **Sponsons** from the menu bar. The Sponson Editor is divided into two sections, port and starboard, which can be selected by the tabs just below the graphic section. For each

sponson section, there are several parameters. The Forward and Aft limits will define the longitudinal extents of the sponson. The Half breadth values are measured from the centerline of the ship. Note that the first deck below the flight deck is not affected by these values, it is assumed by ASSET to have the same footprint as the Flight Deck. The Angles define the slope of the sponson from the shell to the half breadth of the sponson. A value of 90 will cause the described end of the sponson to be transverse. The tables below give the values for the sponsons in our design.

| Port Sponsons | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Forward | Aft | Upper | Middle | Lower | Fwd Angle | Aft Angle |
| 1 | 56 | 253 | 32 | 27.75 | 23.05 | 110 | 15 |
| Starboard Sponsons | | | | | | | |
| | Forward | Aft | Upper | Middle | Lower | Fwd Angle | Aft Angle |
| 1 | 69 | 118 | 34.24 | 28.84 | 23.6 | 135 | 90 |
| 2 | 144 | 191 | 34.24 | 28.84 | 23.6 | 90 | 90 |
| 3 | 215 | 232 | 34.24 | 28.84 | 23.6 | 90 | 60 |

When you have finished the Sponson Editor you should see in the graphics section of the editor a complete layout of the Flight Deck in including the Flight Deck shape, Hangars, Elevators, Sponsons and the Hull Form. Select **OK** to exit the dialogue. The Hangar data was entered in the Hull Subdivision as a Large Object Space.




Now that we have worked our way through the whole set of Flight Deck Editors, we will enter the Air Wing information for our carrier. The air wing we enter will be based on the information we had in the basic requirements section and will help ASSET determine space requirements. Open the ASSET Editor (**Edit, Open Editor**) and navigate the parameter Model Parameter List to AIRCRAFT COMPLEMENT group (**AVIATION SUPPORT, AIRCRAFT COMPLEMENT**). Select the

AIRCRAFT TYPE TBL parameter. This opens an array with 3 columns, which define the type of aircraft, the number of squadrons and the number of aircraft in each squadron respectively. The following table gives the values for our design.

| AIRCRAFT TYPE | # SQUADRONS | AIRCRAFT PER SQUADRON |
|---|---|---|
| F-14A | 1 | 10 |
| FA-18C | 2 | 10 |
| E-2C | 1 | 3 |
| KA-6D | 1 | 3 |
| EA-6B | 1 | 3 |
| S-3A | 1 | 6 |
| SH-60 | 1 | 4 |

After entering the Air Wing data **Close** the Editor and save your data. We will run the Aviation Support Module and allow ASSET to prompt us for any other parameter information needed. To Run the Aviation Support Module, select **Module** then **Run** from the menu bar. When the Run Module dialogue appears, select **AVIATION SUPPORT MODULE,** then **Ok.** ASSET will give the following message and fire up the Editor.

```
** WARNING - AVIATION SUPPORT MODULE ** (W-DKHSNONE-DKHSCK)
 SHIP HAS NO DECKHOUSES.

** FATAL ERROR - AVIATION SUPPORT MODULE ** (E-INVALIDDATA-AVNMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
     MACHY BOX LGTH REQ                  MR LGTH REQ ARRAY
     MR HT REQ ARRAY                     CATAPULT FLIGHT DECK AREA
     CATAPULT C-13-0 NO                  CATAPULT C-13-2 NO
     ELECTROMAG CATAPULT NO              ARRESTING GEAR NO WIRES
     ARRESTING GEAR TYPE IND             AIRCRAFT LANDNG ZONE AREA
     FLIGHT DECK INTERF AREA             HANGAR AREA REQ
     HANGAR MINIMUM WIDTH REQ            HANGAR DIVISION DOOR NO
     SIDE PROTECT OFFSET
```

The ASSET Editor will have all of the missing parameters available so that you can enter values. In many of these cases you will be entering temporary values that will be reset in later modules, but ASSET will use the temporary values to make estimates in the AVIATION SUPORT MODULE. The Aviation Support module calculates a large number of weight and space factors for the entire design based on parameters for a number of different modules. Because this involves information from modules that have not yet been run, ASSET will prompt the user for a large number of parameters.

– The Machinery Room Length & Height Array (based on our Machinery room definition) will look like the following table:

| MR Length | MR Height |
|---|---|
| **9** | **6.84** |

| | |
|---|---|
| **13** | **6.84** |
| **9** | **6.84** |
| **13** | **6.84** |

- The CATAPULT FLIGHT DECK AREA is **3866**$m^2$
- There are **2** C-13-2 Catapults, **0** C-13-0 and Electromagnetic Catapults
- There are **3** arresting wires of **Mk 14** Type
- The Flight Deck landing area is **6764**$m^2$, but there is **1200**$m^2$ Flight Deck Interference area
- The Hangar requires **3838**$m^2$ with a minimum width of **22.85**m and **1** Division Door
- For Side Protection Offset there is **5**m
- The deckhouse requires **2450** cubic meters

Again **Close** the Editor and save your changes. ASSET automatically reruns the Aviation Support Module. This time the Module runs successfully and ASSET provides the following message.

```
** WARNING - AVIATION SUPPORT MODULE ** (W-DKHSNONE-DKHSCK)
 SHIP HAS NO DECKHOUSES.

 ** WARNING - AVIATION SUPPORT MODULE ** (W-TEMPVALUES-AVNMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
     FULL LOAD WT

 ** WARNING - AVIATION SUPPORT MODULE ** (W-DEFAULTVALUES-AVNMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     FLIGHT DECK PLATING ADD            HANGAR AFT BHD LOC
     HANGAR DECK PLATING ADD            AIRCRAFT SVC CONNECT KW
     VAST IND                           AIR COND SYS TYPE IND
     BALLISTIC PROTECTION IND           DEGAUSSING SYSTEM IND
     DEPLOYMENT TIME                    STOWAGE TYPE IND
     NUMBER OF KINGPOSTS                O2/N2 PLANT TYPE IND
     DESIGN STDS IND                    EMER SS GEN NO
     COLL PROTECT SYS IND               AC MARGIN FAC
     POLLUTION CNTL IND                 HAB STD IND
     MANNING ARRAY                      STORES PERIOD ARRAY

 ** WARNING - AVIATION SUPPORT MODULE ** (W-SPSMIDOFF2SMALL-SPSLOS)
 SPS MIDSHIP OFFSET TOO SMALL,      5.2  M

 ** WARNING - AVIATION SUPPORT MODULE ** (W-ADJUSTMINBEAM-AVNAMB)
 ADJUST MINIMUM BEAM -   10.5  M    TO   47.5  M
```

Following the successful run of this module, Save the ship to the databank (**Ship, Modify**). The following is a copy of the summary printed report for the Aviation Support Module.

```
ASSET/MONOCV VERSION 4.3.0 - AVIATION SUPPORT MODULE -   8/ 9/98 13:57.

PRINTED REPORT NO. 1 - SUMMARY

BALLISTIC PROT IND -        CV67 PROT
BLAST RESIST IND -          7 PSI
DESIGN STDS IND -           CURRENT
HAB STD IND -               NAVY
VAST IND -                  VAST

LBP,M                      259.0     HULL VOLUME,M3            204857.
BEAM,M                      37.0     DKHS VOLUME,M3              2450.
DRAFT,M                      5.2     SPONSON VOLUME,M3          44636.
SHIP MAX LENGTH,M          276.8     TOTAL VOLUME,M3           251943.
FLT DK LENGTH,M            276.7
FLT DK HEIGHT,M             26.7     SPONSON DECK AREA,M2       14110.7
USABLE FLT DK AREA,M2     14102.7
HANGAR LENGTH,M            141.4     MAGAZINE AREA,M2            4329.4
HANGAR WIDTH REQ,M          22.9
HANGAR HEIGHT,M              6.4     SPS VOLUME,M3               4293.2
HANGAR AREA,M2            3907.3     SPS DEPTH,M                   12.5
TOTAL AIRCRAFT                .0     SPS OFFSET REQ,M              12.0
TOTAL ACCOM               3536.0     SPS OFFSET,M                   6.8
DEPLOYMENT TIME,DAYS        90.0
MAX SHP,HP              109159.
```

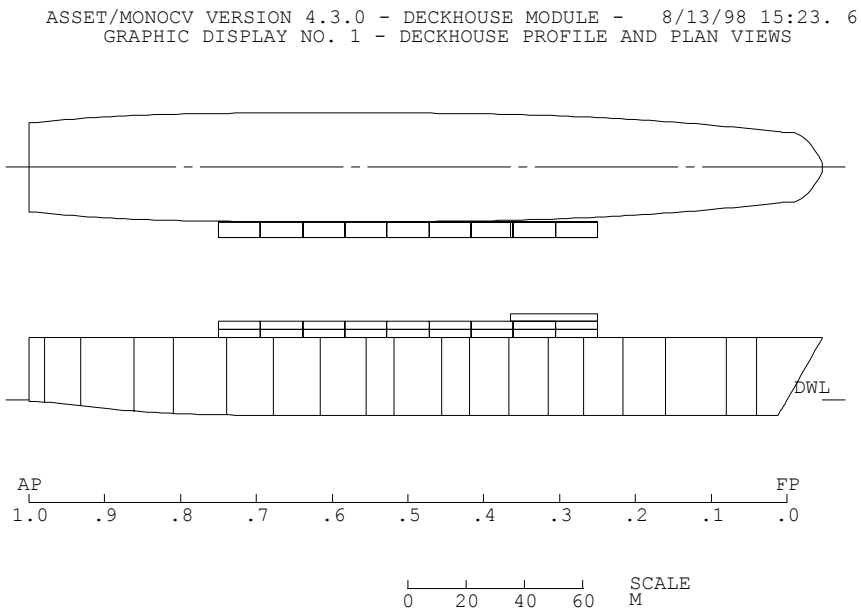
## Section 7.10 – DECKHOUSE MODULE

The next step in the design process is the deckhouse definition. In this module we will let ASSET calculate the Deckhouse based on a few simple parameters we provide. It is also possible to define the deckhouse by giving every geometric shape required to define the deckhouse

We will simply run the Deckhouse Module and let ASSET prompt us for the required parameters. To start the Deckhouse Module, select **Module** then **Run** from the menu bar. When the Run Module dialogue appears, select **DECKHOUSE MODULE,** then **Ok.** ASSET returns the following message and opens the Editor.

```
** FATAL ERROR - DECKHOUSE MODULE ** (E-INVALIDDATA-DHGMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
            DKHS GEOM IND                      DKHS MTRL TYPE IND
```

Since we want ASSET to develop our deckhouse geometry for us, set the DKHS GEOM IND to **GENERATE**. For the DKHS MTRL TYPE IND we will use **STEEL**. Set the BLAST RESIST After entering these values **Close** the Editor and save your changes. ASSET immediately reruns the Deckhouse Module and because it still needs additional parameter information, opens the Editor. For DKHS SIZE IND set the value to **MAX**. **Close** the Editor and save your changes. ASSET immediately reruns the Deckhouse Module and this time the run is successful. In order to check the deckhouse that ASSET has created for us, we will run the Deckhouse Module again after turning on the Graphic Reports for the Deckhouse Module. To turn on the reports for the Deckhouse Module, select **Module** then **Select Reports** from the menu bar. In the Select Reports Dialogue, select the **DECKHOUSE MODULE**, then set **All** of the graphic reports on. Run the Deckhouse Module again (**Module, Run, DECKHOUSE MODULE, Ok**). When the module finishes running, you can see the deckhouse ASSET has created in graphic reports. The Deckhouse is a long slender box on the Starboard side of the ship, but it is not what we want for our design.

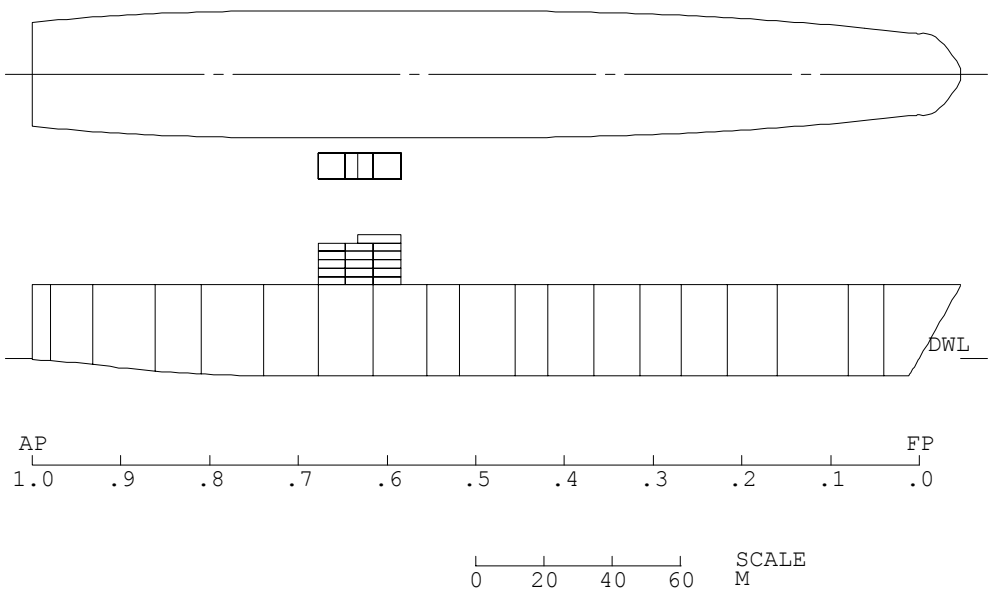



In order get the deckhouse design to what we want, we will go into the ASSET parameters and provide ASSET with additional information. Open the ASSET editor (**Edit, Open Editor**) and navigate the Model Parameter List to get to the DECKHOUSE Group of parameters (**HULL, DECKHOUSE**). In order to shorten the length of the deckhouse, we have to adjust the DKHS LIMITS ARRAY. This array defines the longitudinal limits of the deckhouse, with the distances expressed as a percentage of the ship's length. The default values are 0.25 & 0.75. For our design we want to limit the deckhouse to **.556** & **.678**. The DKHS OUTBD SIDE LOC locates the outboard edge of the deckhouse, for our design we want to move our deckhouse outboard, so we set the DKHS OUTBD SIDE LOC to **30.5**m. We will also set our DKHS WIDTH to **7.5**m, the DKHS AVG DK HT **2.45**m and the DKHS NO LEVELS to **6**. **Close** the Editor and save your changes. Run the Deckhouse Module again.

Again the graphics reports will be produced and this time the deckhouse is taller with a much smaller footprint. The graphic reports for the Deckhouse Module do not show the Flight Deck, so you have to look at the location for the deckhouse to make sure that the deckhouse footprint is within the Flight Deck outline.

Following the successful run of this module, Save the ship to the databank (**Ship, Modify**). The following is a copy of the summary printed report for the Deckhouse Module and the first graphic report for the Deckhouse Module.

ASSET/MONOCV VERSION 4.3.0 - DECKHOUSE MODULE - 8/11/98 9:32.28
GRAPHIC DISPLAY NO. 1 - DECKHOUSE PROFILE AND PLAN VIEWS




ASSET/MONOCV VERSION 4.3.0 - DECKHOUSE MODULE - 8/ 9/98 18:49.59

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE
DKHS SIZE IND-MAX
BEAM LINK IND-NO

BLAST RESIST IND-7 PSI
DKHS MTRL TYPE IND-STEEL

| | | | |
|---|---|---|---|
| LBP, M | 259.00 | DKHS LENGTH OA, M | 24.35 |
| BEAM, M | 37.00 | DKHS MAX WIDTH, M | 7.50 |
| AREA BEAM, M | 37.00 | DKHS HT (W/O PLTHS), M | 14.70 |
| DKHS FWD LIMIT- | STA 11.7 | OTHER ARR AREA REQ, M2 | 12075. |
| DKHS AFT LIMIT- | STA 13.6 | HULL ARR AREA AVAIL, M2 | 50506. |
| DKHS AVG DECK HT, M | 2.45 | SPONSON ARR AREA AVAIL, M2 | 14111. |
| DKHS NO LVLS | 6. | DKHS ARR AREA REQ, M2 | 6708. |
| DKHS MIN SIDE CLR, M | -12.00 | HANGAR ARR AREA REQ, M2 | 0. |
| DKHS AVG SIDE ANG, DEG | .00 | PLTHS ARR AREA REQ, M2 | 161. |
| DKHS OUTBOARD SIDE LOC,M | 30.50 | | |
| DKHS NO PRISMS | 16 | DKHS MAX ARR AREA, M2 | 1056. |
| DKHS ARR AREA DERIV, M2 | 43.79 | DKHS ARR AREA AVAIL, M2 | 1056. |
| DKHS MIN ALW BEAM, M | 29.50 | DKHS VOLUME, M3 | 2639. |
| BRIDGE L-O-S OVER BOW, M | 253.92 | | |
| | | DKHS WEIGHT, MTON | 441.40 |
| DKHS SIDE CLR OFFSET, M | | DKHS VCG, M | 34.07 |
| DKHS SIDE ANG OFFSET, DEG | | | |
| DKHS DECK HT OFFSET, M | | | |

## Section 7.11 – HULL STRUCTURE

The next step in the design using ASSET is to define the hull structure. Similar to the Deckhouse construction, we will be allowing ASSET to determine most of the hull structure based on a few simple parameters we provide. We will also be using the prompt mode again to have ASSET provide the parameters to us for which it needs information.

The first step will be to run the Hull Structure Module. In order to run the Hull Structure Module, the Hull Subdivision must be run first. If you have not run the Hull Subdivision Module since the last time you saved the model to the databank, do so now. To start the Hull Structure Module, select **Module** then **Run** from the menu bar. When the Run Module dialogue appears, select **HULL STRUCT MODULE,** then **Ok.** ASSET returns the following message and opens the Editor.

```
C,M>RUN, HULL STRUCT MODULE

 ** FATAL ERROR - HULL STRUCT MODULE ** (E-INVALIDDATA-HSTMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
     HULL LOADS IND                      BOT PLATE LIMIT IND
     FRAME SPACING                       DECK SUPPORT LOC ARRAY
     DECK SUPPORT TYPE TBL               BOTTOM FLOOR LOC ARRAY
     STIFFENER SHAPE IND
```

- For our design we will set the HULL LOADS IND to **CALC**
- The BOT PLATE LIMIT IND is **CALC**
- The FRAME SPACING will be **1. 5** m
- The DECK SUPPORT LOC ARRAY, DECK SUPPORT TYPE TBL and BOTTOM FLOOR LOC ARRAY define the transverse location of major longitudinal structure supports. The following table gives the values for these parameters:

| Deck Support Loc | Deck Support Type | Bottom Floor Loc |
|---|---|---|
| **.2** | **GIRDER** | **.2** |
| **.6** | **GIRDER** | **.4** |
| | | **.6** |
| | | **.8** |

- The STIFFENER SHAPE IND should be set to **CALC**
- There are **2** propeller shafts in our design

**Close** the Editor and save your changes. ASSET will automatically rerun the Hull Struct Module and the run is successful. ASSET gives you the following message:

```
C,M>RUN, HULL STRUCT MODULE

 ** WARNING - HULL STRUCT MODULE ** (W-DEFAULTVALUES-HSTMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     HULL MTRL TYPE TBL                  HULL MARGIN STRESS
     HOG BM CONSTANT                     SAG BM CONSTANT
     SHEER STRAKE WIDTH                  STRINGER PLATE WIDTH
```

```
    STRUCTURAL CRITERIA IND            STRUCTURAL DESIGN IND
    STRUCTURAL DESIGN LOC              GDR SPAN FACTOR
    STIFFENER SPACING ARRAY            FULL LOAD WT
 0/ 0  AT   424.87 FROM   -39.60 TO   849.74

** WARNING - HULL STRUCT MODULE ** (W-PLTTKOUTCATLOG-BTFRAM)
PLATE THICKNESS EXCEEDS CATALOG RANGE IN THE DESIGN OF
NO. 1 SEGMENT FOR BOTTOM FRAME
                              -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT  60.64     13.99
    SEGMENT LOWER NODE POINT  48.54       .40

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00     77.46
    SEGMENT LOWER NODE POINT  60.67     77.46

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00     66.96
    SEGMENT LOWER NODE POINT  60.67     66.96

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00     56.47
    SEGMENT LOWER NODE POINT  60.67     56.47

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00     45.14
    SEGMENT LOWER NODE POINT  60.67     45.14

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00     33.81
    SEGMENT LOWER NODE POINT  60.67     33.81

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00     23.99
    SEGMENT LOWER NODE POINT  60.66     23.99

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00     13.99
    SEGMENT LOWER NODE POINT  60.64     13.99

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG-DKBEAM)
THE STIFFENER SIZE IS OUT OF THE RANGE OF THE CATALOG OR THE
SMEAR RATIO IN THE DESIGN OF NO. 1 SEGMENT FOR THE
    INT.DECK BEAM             -----COORD-----
                                Y         Z
    SEGMENT UPPER NODE POINT    .00      4.00
```

```
    SEGMENT LOWER NODE POINT  58.60      4.00

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG1-HSTMSG)
STIFFENER SIZE IS OUT OF THE RANGE OF CATALOG OR THE VALUE FOR
SMEAR RATIO IN THE DESIGN OF TRANS. BHD

** WARNING - HULL STRUCT MODULE ** (W-STIFFOUTCATLOG1-HSTMSG)
STIFFENER SIZE IS OUT OF THE RANGE OF CATALOG OR THE VALUE FOR
SMEAR RATIO IN THE DESIGN OF DECK GIRDER

** WARNING - HULL STRUCT MODULE ** (W-PLTTKOUTCATLOG1-HSTMSG)
PLATE THICKNESS EXCEEDS THE CATALOG RANGE IN THE DESIGN OF
    BOTTOM GIRDER
```

Although the run was successful, a large number of warnings about the design have been issued by ASSET. In addition a number of parameters that we may want to consider have been given default values (such as material type). Take some time to look at the parameters to which ASSET assigned default values.

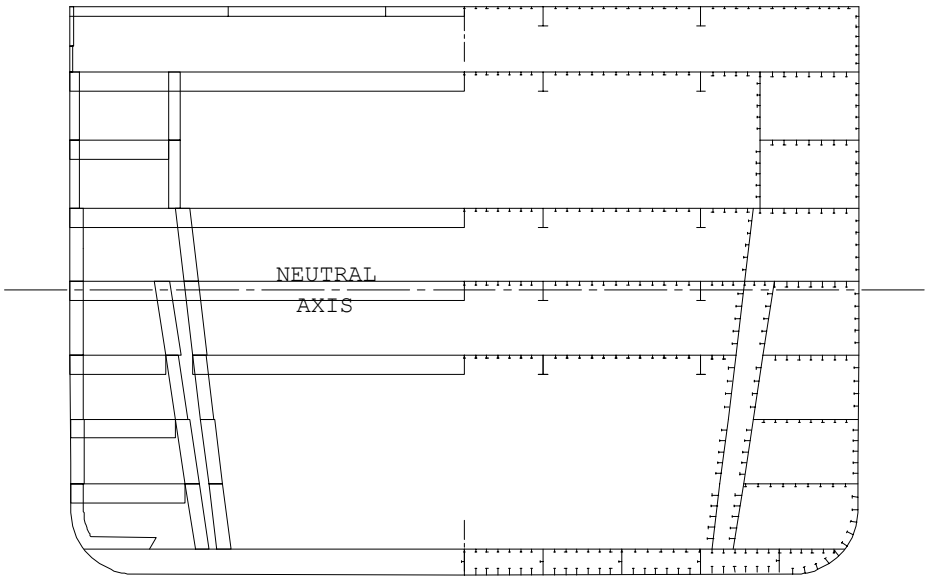
ASSET has set all of the material type throughout the ship to mild steel. This will have a significant impact on the structural weight of our design. Take a moment to look in the summary printed summary report for the total weight of the structure. It should be about 29000 tons. For our tutorial we will want to alter the material types. Open the Editor (**Edit, Open Editor**) and navigate the Model Parameter List to HULL MATERIALS (**HULL, HULL STRUCTURES, HULL MATERIALS**). Select the HULL MTRL TYP TBL. The following table gives the values for the array. The left column is for plate, the right for stiffeners. Use the help index to see to which section of the structure each line applies.

| | |
|---|---|
| HY 100 | HTS |
| HY 80 | HTS |
| HY 80 | HTS |
| HTS | HTS |
| HTS | HTS |
| HTS | OS |
| OS | OS |
| OS | OS |

Turn on the graphic reports for the Hull Struct Module. To turn on the reports for the Hull Struct Module, select **Module** then **Select Reports** from the menu bar. In the Select Reports Dialogue, select the **HULL STRUCT MODULE**, then set **All** of the graphic reports on. Run the Hull Struct Module again. If you look at the structural weight total it has been reduced to about 17500 tons. Look at the graphic reports to make sure that the structural design looks reasonable and smooth, with no abrupt changes in the scantlings.

Following the successful run of this module, Save the ship to the databank (**Ship, Modify**). The following is a copy of the summary printed report and the first graphic report for the Hull Struct Module.

ASSET/MONOCV VERSION 4.3.0 - HULL STRUCT MODULE - 8/11/98 9:34.59
GRAPHIC DISPLAY NO. 1 - SECTION AT THE STRUCTURAL DESIGN LOCATION




```
ASSET/MONOCV VERSION 4.3.0 - HULL STRUCT MODULE -   8/ 9/98 19:30. 7

 PRINTED REPORT NO. 1 - SUMMARY

 INNER BOT IND-   PRESENT              HULL LOADS IND-CALC
 STIFFENER SHAPE IND-CALC

 ---------------------- HULL STRENGTH AND STRESS ----------------------
 HOGGING BM, M-MTON        387654.     PRIM STRESS KEEL-HOG, MPA   95.71
 SAGGING BM, M-MTON        323045.     PRIM STRESS KEEL-SAG, MPA   79.75
 MIDSHIP MOI, M2-CM2      4412572.     PRIM STRESS DECK-HOG, MPA  115.46
 DIST N.A. TO KEEL, M        12.08     PRIM STRESS DECK-SAG, MPA   96.22
 DIST N.A. TO DECK, M        15.14     HULL MARGIN STRESS, MPA     15.44
 SEC MOD TO KEEL, M-CM2      8774.     SEC MOD TO DECK, M-CM2      7001.
 HULL STRUCTURE COMPONENTS
                    MATERIAL   NO OF    NO
                      TYPE    SEGMENT
                    -----------------------
   WET. DECK        MS           4        1
   SIDE SHELL       MS           8        1
   BOTTOM SHELL     MS           5        1
   INNER BOTTOM     MS           4        1
   INT. DECK        MS           4        8
   STRINGER, SHEER MS            1        1
   LONG BULKHEAD    MS                    6
   TRANS BULKHEAD   MS                   18
 HULL STRUCTURE WEIGHT
 SWBS    COMPONENT                WEIGHT, MTON    VCG, M
 ---------------------------------------------------------
 100  HULL STRUCTURE               28955.4        12.11
   110   SHELL+SUPPORT              10950.0         9.20
   120   HULL STRUCTURAL BHD         4148.1        12.52
   130   HULL DECKS                 13857.2        14.29
           140   HULL PLATFORM/FLATS
```

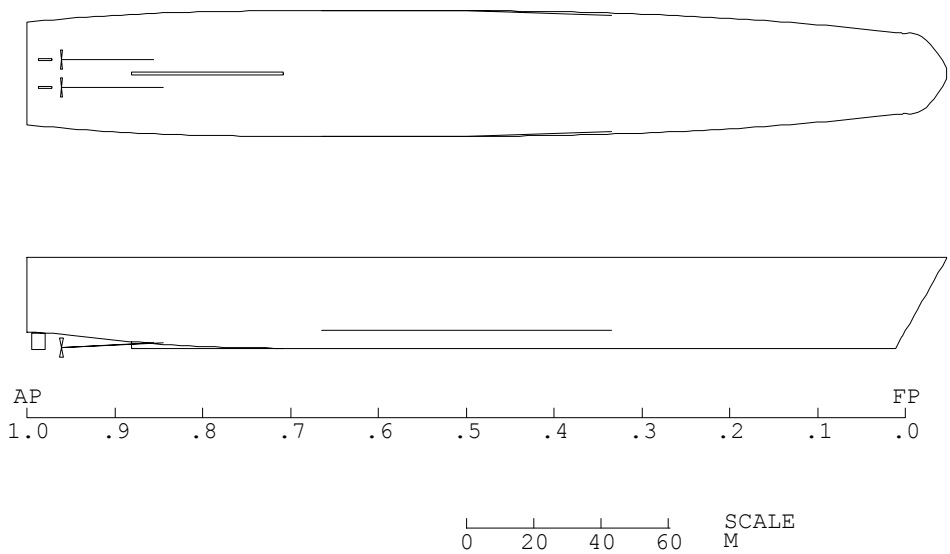
## Section 7.12 – APPENDAGE MODULE

Run the Appendage module (**Module, Run, APPENDAGE MODULE, Ok**). This module defines the geometry of hull appendages (except propulsion-related appendages) and computes their displacements. Your design has bilge keels, a skeg, 2 prop shafts, an open strut shaft support, a fixed pitch propeller and no sonar dome. When the module is complete, the following appears:

```
C,M>RUN, APPENDAGE MODULE
 ** WARNING - APPENDAGE MODULE ** (W-DEFAULTVALUES-APGMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     SKEG THK                           NO RUDDERS
     NO FIN PAIRS

 ** WARNING - APPENDAGE MODULE ** (W-TEMPVALUES-APGMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
     PROP DIA                           SHAFT ANGLE ARRAY
     PROP LOC ARRAY                     RUDDER SIZE ARRAY
     APPENDAGE DISP ARRAY               APPENDAGE CB ARRAY
```

Following the successful run of this module, Save the ship to the databank (**Ship, Modify**). The Appendage module Summary printed report and Ship Profile/Plan View Appendages graphic report follow.

ASSET/MONOCV VERSION 4.3.0 - APPENDAGE MODULE - 8/11/98 9:40.36
GRAPHIC DISPLAY NO. 1 - HULL PROFILE AND PLAN VIEW WITH APPENDAGES




ASSET/MONOCV VERSION 4.3.0 - APPENDAGE MODULE - 9/ 9/1998 13:27. 0
Databank C:\ASSET43A\MCV430.BNK - Ship Name is TUTORIAL 43E

PRINTED REPORT NO. 1 - SUMMARY

| | | | |
|---|---|---|---|
| APPENDAGE DISP, MTON | 328.4 | | |
| SHELL DISP, MTON | 75.4 | | |
| SKEG IND | PRESENT | RUDDER TYPE IND | |
| SKEG DISP, MTON | 7.3 | NO RUDDERS | 2 |
| SKEG AFT LIMIT/LBP | .8438 | AVG RUDDER CHORD, M | 4.26 |
| SKEG THK, M | .61 | RUDDER THK, M | .48 |
| SKEG PROJECTED AREA, M2 | 11.7 | RUDDER SPAN, M | 5.18 |
| | | RUDDER PROJECTED AREA, M2 | 22.1 |
| BILGE KEEL IND | PRESENT | RUDDER DISP, MTON | 74.8 |
| BILGE KEEL DISP, MTON | 42.4 | | |
| BILGE KEEL LGTH, M | 85.47 | FIN SIZE IND | |
| | | NO FIN PAIRS | 0 |
| SHAFT SUPPORT TYPE IND | OPEN STRUT | FWD FIN | |
| SHAFT SUPPORT DISP, MTON | 93.5 | CHORD, M | |
| SHAFT DISP, MTON | 24.3 | THK, M | |
| | | SPAN, M | |
| PROP TYPE IND | FP | PROJECTED AREA, M2 | |
| PROP BLADE DISP, MTON | 10.6 | DISP, MTON (PER PAIR) | |
| NO PROP SHAFTS | 2 | AFT FIN | |
| PROP DIA, M | 5.54 | CHORD, M | |
| | | THK, M | |
| SONAR DOME IND | NONE | SPAN, M | |
| SONAR DISP, MTON | .0 | PROJECTED AREA, M2 | |
| | | DISP, MTON (PER PAIR) | |

## Section 7.13 – RESISTANCE MODULE

Run the Resistance Module (**Module, Run, RESISTANCE MODULE, Ok**). This module calculates ship resistance based on the sum of frictional, residuary, appendage, and wind resistance (plus a resistance margin). Calm seas and a clean hull are assumed.

```
C,M>RUN, RESISTANCE MODULE
 ** FATAL ERROR - RESISTANCE MODULE ** (E-INVALIDDATA-RSTMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
     PRPLN SYS RESIST IND              FRICTION LINE IND
     RESID RESIST IND
```

Notice the parameters that contain missing or invalid data. Remember to use the on-line help for each parameter that is unclear. ASSET will open the Editor with these parameters.

- For PRPLN SYS RESIST IND, choose the **CALC** option.
- Choose the **ITTC** friction line.
- Use **TAYLOR** for the RESID RESIS IND.

**Close** the Editor and Save your changes. ASSET will automatically rerun the Resistance Module. Again ASSET needs additional information, so it opens the Editor and prompts you for the missing information.

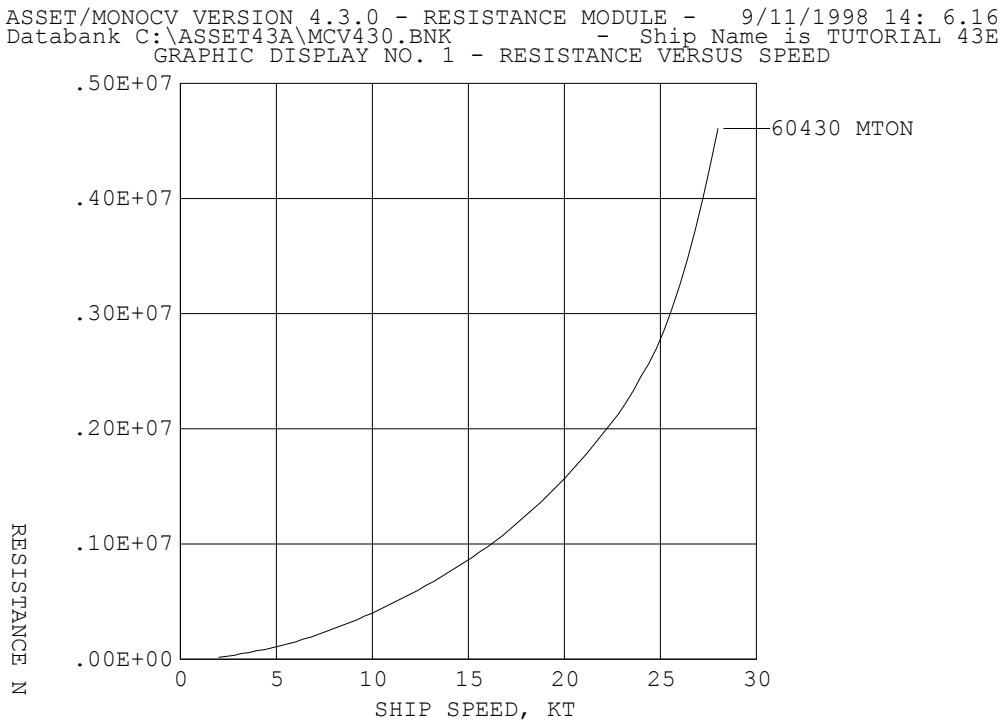
- Use **one** strut per shaft.
- Set RUDDER TYPE IND to **HORN**.
- Set THRUST DED COEF to **0.1**.
- Set TAYLOR WAKE FRAC to **0.05**.
- Set the WORM CURVE IND to **CVV**.

**Close** the Editor and Save your changes. ASSET will automatically rerun the Resistance Module. ASSET returns the following message along with a successful run.

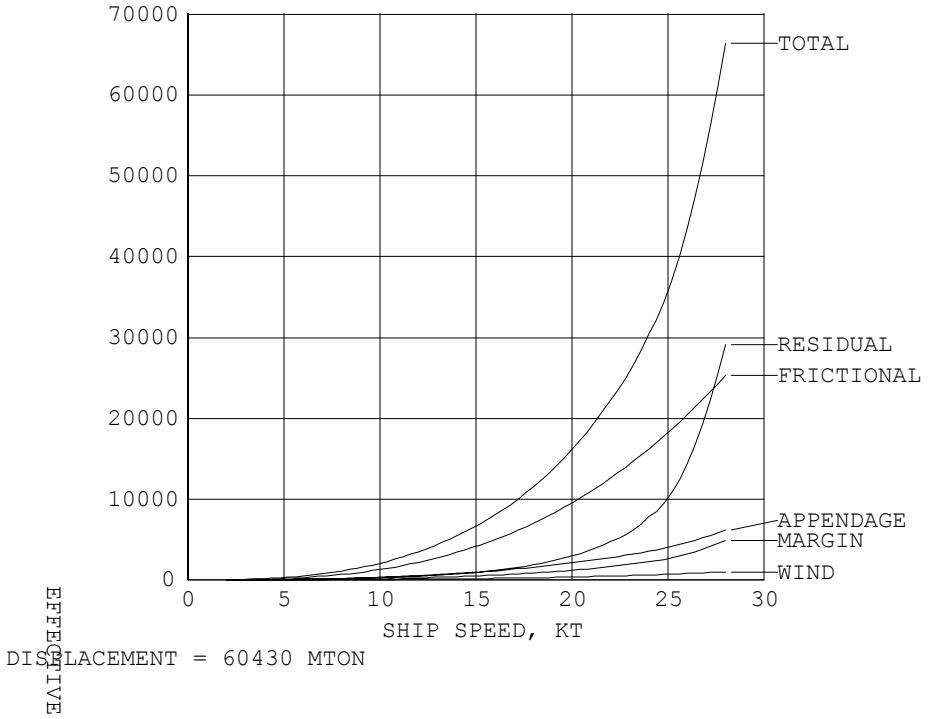
```
C,M>RUN, RESISTANCE MODULE
 ** WARNING - RESISTANCE MODULE ** (W-TEMPVALUES-RSTMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
     PROP DIA                          SHAFT DIA ARRAY
     STRUT DIM ARRAY                   SHAFT ANGLE ARRAY
     PROP LOC ARRAY                    RUDDER SIZE ARRAY
     SHIP FUEL SP VOL                  APPENDAGE DISP ARRAY

 ** WARNING - RESISTANCE MODULE ** (W-DEFAULTVALUES-RSTMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     DKHS WIND AREA FAC ARRAY          PROP TIP CLR RATIO ARRAY
     DRAG MARGIN FAC                   CORR ALW

 ** WARNING - RESISTANCE MODULE ** (W-FHULPAROUTRNG-RESIST)
 AT THE FULL LOAD DRAFT, VALUES OF THE FOLLOWING HULL FORM
 PARAMETERS ARE OUT OF RANGE:
```

```
FROUD W.S. COEF                    BEAM-DRAFT RATIO
```

Review the parameters that were given default values. Following the successful run of this module, Save the ship to the databank (**Ship, Modify**). The Resistance Module summary printed report and resistance vs. speed and EHP vs. speed plots follow.



ASSET/MONOCV VERSION 4.3.0 - RESISTANCE MODULE - 9/11/1998 14: 6.16
Databank C:\ASSET43A\MCV430.BNK - Ship Name is TUTORIAL 43E
GRAPHIC DISPLAY NO. 2 - EHP VERSUS SPEED




DISPLACEMENT = 60430 MTON

ASSET/MONOCV VERSION 4.3.0 - RESISTANCE MODULE - 9/ 9/1998 14:14.44
Databank C:\ASSET43A\MCV430.BNK - Ship Name is TUTORIAL 43E

PRINTED REPORT NO. 1 - SUMMARY

| | | | |
|---|---|---|---|
| RESID RESIST IND | TAYLOR | BILGE KEEL IND | PRESENT |
| FRICTION LINE IND | ITTC | SHAFT SUPPORT TYPE IND | OPEN STRUT |
| ENDUR DISP IND | FULL LOAD | PRPLN SYS RESIST IND | CALC |
| PROP TYPE IND | FP | RUDDER TYPE IND | HORN |
| SONAR DRAG IND | | SONAR DOME IND | NONE |
| SKEG IND | PRESENT | | |
| FULL LOAD WT, MTON | 32801.6 | CORR ALW | .00024 |
| AVG ENDUR DISP, MTON | 32801.6 | DRAG MARGIN FAC | .080 |
| USABLE FUEL WT, MTON | 5236.6 | | |
| NO FIN PAIRS | 0. | PRPLN SYS RESIST FRAC | |
| NO RUDDERS | 2. | MAX SPEED | .093 |
| NO PROP SHAFTS | 2. | SUSTN SPEED | .084 |
| PROP DIA, M | 5.54 | ENDUR SPEED | .107 |

| CONDITION | SPEED----------EFFECTIVE HORSEPOWER, KW---------- | | | | | | | DRAG |
|---|---|---|---|---|---|---|---|---|
| | KT | FRIC | RESID | APPDG | WIND | MARGIN | TOTAL | N |
| MAX | 24.00 | 13506. | 5892.* | 2987. | 748. | 1851. | 24983. | 2023454. |
| SUSTN | 26.00 | 17036. | 9885.* | 3821. | 951. | 2535. | 34228. | 2558999. |
| ENDUR | 20.00 | 7960. | 2368.* | 1774. | 433. | 1003. | 13538. | 1315805. |

.

## Section 7.14 – PROPELLER MODULE

Run the Propeller Module (**Module, Run, PROPELLER MODULE, Ok**). This module determines the geometric characteristics of the ship's propeller(s) and calculates the power that must be supplied to achieve various speeds.

```
C,M>RUN, PROPELLER MODULE
 ** FATAL ERROR - PROPELLER MODULE ** (E-INVALIDDATA-PRPMPL)
 THE FOLLOWING PARAMETERS CONTAIN INVALID OR MISSING DATA:
     PROP SERIES IND                    PROP DIA IND
     PROP AREA IND                      PROP LOC IND
```

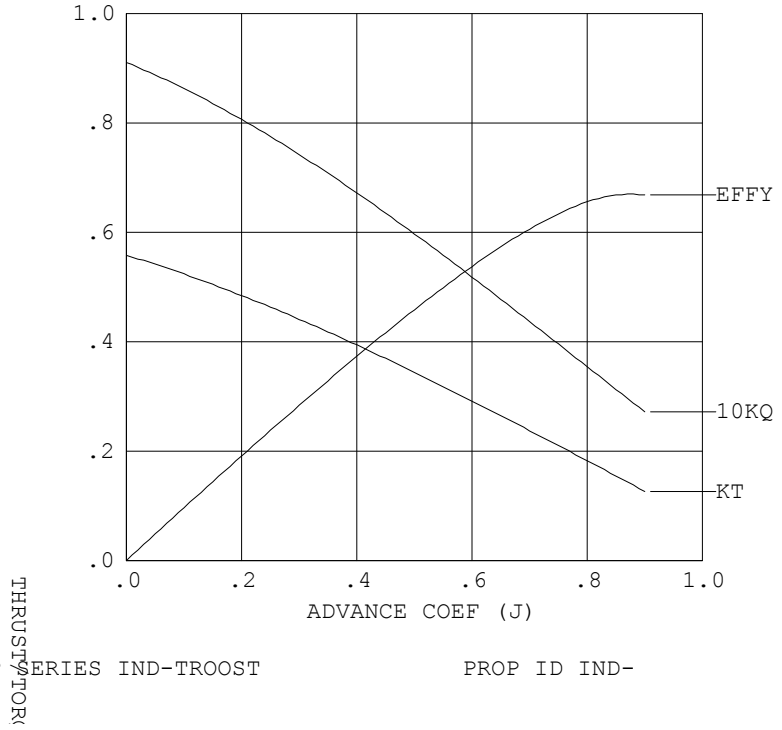
Notice the parameters that contain missing or invalid data. Remember to use the on-line help for each parameter that is unclear. ASSET will open the Editor with these parameters.

For the PROP SERIES IND, choose **TROOST**. Choose **CALC** for the propeller's diameter, area, and location. Running the modules again yields:

```
C,M>RUN, PROPELLER MODULE
 ** WARNING - PROPELLER MODULE ** (W-TEMPVALUES-PRPMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
     SHAFT ANGLE ARRAY                  RUDDER SIZE ARRAY

 ** WARNING - PROPELLER MODULE ** (W-DEFAULTVALUES-PRPMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     REL ROTATE EFF                     BACK CAV ALW
     BLADE NUMBER ARRAY                 PROP RPM LIMIT ARRAY
     ANALYTIC2 ADJ FAC ARRAY            PROP ROOT BEND STRESS
     PROP HUB SOLIDITY
```

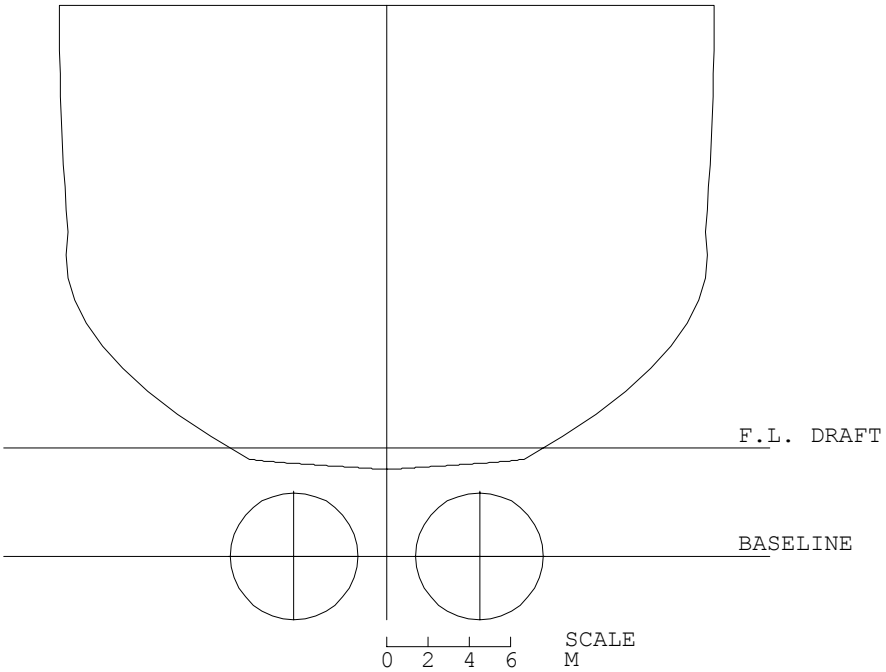
Everything is OK for now. . Following the successful run of this module, save the ship to the databank (**Ship, Modify**). The Propeller module Summary printed report and the two propeller Graphic reports (open water diagram and transverse section) follow.

ASSET/MONOCV VERSION 4.3.0 - PROPELLER MODULE - 8/11/98 10: 4.21
GRAPHIC DISPLAY NO. 1 - OPEN WATER DIAGRAM




PROP SERIES IND-TROOST PROP ID IND-

ASSET/MONOCV VERSION 4.3.0 - PROPELLER MODULE - 8/11/98 10: 4.21
GRAPHIC DISPLAY NO. 2 - TRANSVERSE SECTION

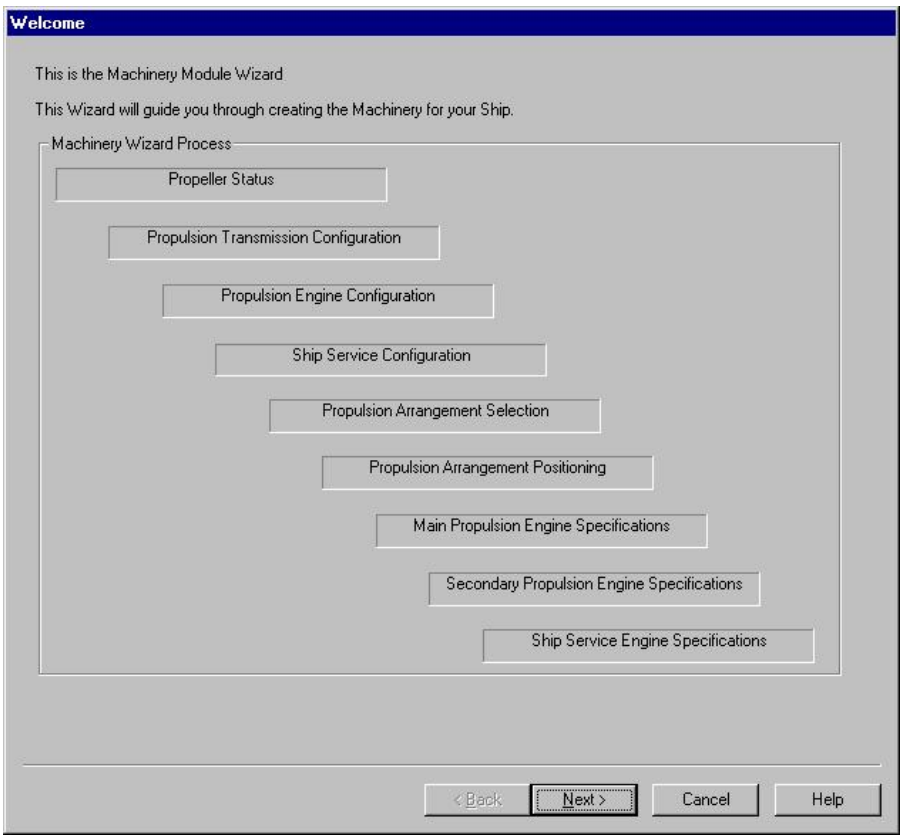


```
 ASSET/MONOCV VERSION 4.3.0 - PROPELLER MODULE -   8/ 9/98 20: 3.17

PRINTED REPORT NO. 1 - SUMMARY

PROP TYPE IND                  FP     PROP SERIES IND            TROOST
PROP DIA IND                 CALC     PROP LOC IND                 CALC
PROP AREA IND                CALC     PROP ID IND
SHAFT SUPPORT TYPE IND OPEN STRUT

MAX SPEED, KT               28.00     ENDUR SPEED, KT             20.00
MAX EHP (/SHAFT), KW       19791.     ENDUR EHP (/SHAFT), KW      5461.
MAX SHP (/SHAFT), KW       27996.     ENDUR SHP (/SHAFT), KW      7620.
MAX PROP RPM               170.0     ENDUR PROP RPM              115.1
MAX PROP COEF               .707     ENDUR PROP COEF              .717

SUSTN SPEED, KT             26.00     PROP DIA, M                 5.66
SUSTN EHP (/SHAFT), KW      4141.     NO BLADES                     5.
SUSTN SHP (/SHAFT), KW      6376.     PITCH RATIO                 1.14
SUSTN PROP RPM              130.4     EXPAND AREA RATIO           .725
SUSTN PROP COEF              .650     CAVITATION NO               1.43
NO PROP SHAFTS                2.0

TOTAL PROPELLER WT, MTON    51.16
```

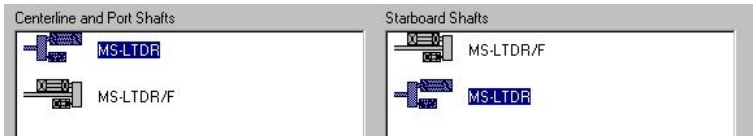
## Section 7.15 – MACHINERY MODULE

For the Machinery Module, we will be using the Machinery Wizard tool to help create the machinery design for our ship. This tool is intended to walk the user through the parameters required to define the Machinery plant in ASSET. Because we are building a ship with a steam powerplant, there is a small amount of preparatory we have to do to make the Machinery Wizard work successfully. We need to load templates for High Pressure (HP) and Low Pressure (LP) Steam plants into the ASSET Model. By using components available in the databank we will be able to access this data. To load the components select **Ship** then **Use** from the menu bar. In the Use Ship or Component dialogue, select the **25K CONV HP STEAM TURBINE** Component and **Ok** the form. Repeat this, but select **25K CONV LP STEAM TURBINE** the second time.

Now that we have loaded the templates for our steam plants we can start the Machinery Wizard. To do this, select **Module** then **Machinery Module Wizard** from the menu bar. If you have not run the Hull Subdivision Module since the last time you entered ASSET, ASSET will run it at this time.



**Wizard Screens**

1. The Welcome Screen shows you the steps involved defining the machinery. Once you are familiar with the steps select **Next**.
2. The Propeller Status Screen shows us the parameters we have set for the propeller design. If all the values are fine select **Next**.
3. On the Propulsion Transmission Configuration Screen select **Mechanical** Transmission Type – the Shaft Support should already be **Open Strut** . Select **Next** once you have entered the values on this screen.
4. The Propulsion Engine Configuration Screen will show all of the parameters we have already defined for the engines. It should say that both main and secondary engines exist and are used at sustained speed. The Main Engine should be **1200psi Steam Turbine**; the Secondary Engine **1200psi Steam Turbine**. The sustained speed is **26** knots and the endurance speed is **20** knots. Once you have verified all of the values select **Next**.
5. The Ship-Service Configuration Screen has a few parameters you will have to fill out. Set the Ship-service kW ratings to be calculated by the module (**Standard**). Select **Domestic Diesel** for the Conventional Ship Service Engine Generator Set. Check the box for Propulsion-derived Ship Service System and select **Steam Turbine Generator Set**. Select **Next** after entering all of the data.
6. The Mechanical Propulsion Arrangement Selection Screen will define the layout of our engines. Select **MS-LTDR** 

for both port and starboard engines. Select **Next**.
7. The Mechanical Propulsion Arrangement Positioning Screen defines the location of the machinery components in the Machinery Rooms. Place the Port Propulsion unit in MR 4 (put a **1**) in the box and the Starboard Propulsion Unit in MR 2. Don't worry about the VCG values right now, we will let ASSET place default values and adjust them later. Place **1** SS Eng Gen in each AMR (MR 1 & 3) and **1** PD Steam Turbine in each MMR (MR 2 & 4) and 2 PD Steam Turbine in each MMR (MR 1 & 3). Select **Next**.

8. The Main Propulsion Engine Specifications Screen defines the characteristics of the Main Engines. The box should be checked for the user selection and **OTHER** should be the model selected. The Scale Engine box should be checked. The parameters in the Engine Characteristics Reference section are based on the component we read in earlier and do not need to be adjusted. Select **Next**.
9. The Secondary Propulsion Engine Specifications Screen defines the characteristics of the Secondary Engines. The box should be checked for the user selection and **OTHER** should be the model selected. The Scale Engine box should be checked. The parameters in the Engine Characteristics Reference section are based on the component we read in earlier and do not need to be adjusted. Select **Next**.
10. The Ship Service Engine Specifications Screen defines the characteristics of the Ship Service Engines. The box should be checked for the user selection. For our design we will use the **GM 16-645E5.** Select **Finish** to complete the Machinery Wizard.

When you exit the Machinery Wizard ASSET notifies you that several parameters have been given default values. The program then notifies you that the battle and cruise operating numbers for the propulsion derived ship service generators are also given default values. Before we run the Machinery Module, we need to adjust several parameters. Open the Editor (**Edit, Open Editor**) and navigate the Model Parameter List to MAIN ENGINES (**PROPULSION PLANT, PROPULSION UNITS, MAIN ENGINES**). Use the Find tool in the Editor to find the PD SS SYS OP ARAY. Set the numbers in this array to **3** & **3**. Next to this parameter is the SEP SS SYS OP ARRAY. Set the values for this array to **0** & **0**. **Close** the Editor and save your changes.

Run the Resistance and Propeller Modules if you have not run them since the last time you entered ASSET. Set all of the graphic reports on for the Machinery Module. Run the Machinery Module (**Module, Run, MACHINERY MODULE, Ok**). ASSET asks for the value of the SEP SS GEN KW. Set the value to **2000** kW. **Close** the Editor and save your changes. ASSET automatically reruns the Machinery Module. The module runs successfully and ASSET provides the following messages:

```
C,M>RUN, MACHINERY MODULE
 ** WARNING - MACHINERY MODULE ** (W-DEFAULTVALUES-MHYMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     ARR ROT ANGLE ARRAY                MACHY CLR ARRAY
     HULL CLR ARRAY                     ENG ENDUR RPM IND
     NO BOILERS PER SHAFT               NO RESERVE BOILERS
```

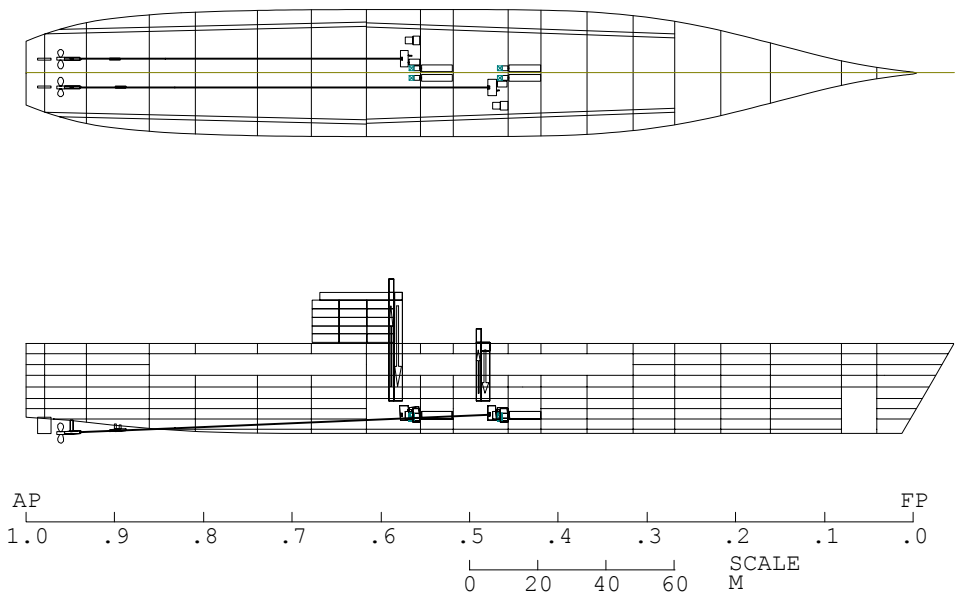
```
    AUX STEAM FAC                       GEAR CASING WT FAC ARRAY
    GEAR FACE RATIO ARRAY               GEAR K FAC ARRAY
    SHAFT BORE RATIO ARRAY              TORQUE MARGIN FAC
    PROP OFF-CNTR THRUST FAC            SHAFT SAFETY FAC ARRAY
    SHAFT SIGMA ARRAY                   INTAKE DUCT DES VEL ARRAY
    400-HZ ELECT LOAD FAC               ELECT LOAD DES MARGIN FAC
    ELECT LOAD SL MARGIN FAC            PD SS ADJ FAC ARRAY
    COMP HEATING TYPE IND               AUX BOILER TYPE IND
    RUDDER SIZE IND                     BALLAST FUEL FRAC
    SWBS KEY TBL                        SWBS WT ARRAY

** WARNING - MACHINERY MODULE ** (W-TEMPVALUES-MHYMPL)
THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
    SHIP EHP EXPNT ARRAY

** WARNING - MACHINERY MODULE ** (W-GRPITCHLINEVEL-G01SIZ)
PITCH LINE VELOCITY FOR INPUT PINION OF GEAR  1 EXCEEDS LIMIT.
GEAR FACE WIDTH OR K FACTOR SHOULD BE INCREASED.
    ACTUAL VELOCITY, M/SEC     107.58
    LIMITING VELOCITY, M/SEC   101.50

** WARNING - MACHINERY MODULE ** (W-ENGSEPNOTOK4GR-G01SIZ)
ACTUAL SEPARATION OF ENGINE CENTERLINES IS NOT WITHIN
ALLOWABLE BOUNDS FOR GEARBOX.
    MIN ALW SEP, M               3.26
    MAX ALW SEP, M               4.08
    ACTUAL  SEP, M                2.02

** WARNING - MACHINERY MODULE ** (W-TORQGOVRNSHDIA-SHSIZO)
PROPELLER SHAFT DIAMETER IS GOVERNED BY TORQUE.

** WARNING - MACHINERY MODULE ** (W-MRDIM2SMALL-MRDIMR)
DIMENSIONS OF THE FOLLOWING MACHINERY ROOMS ARE TOO SMALL
TO ENCLOSE MACHINERY : 1, 2, 3, 4

** WARNING - MACHINERY MODULE ** (W-LEFTRIGHTGEARREQ-MHYMSG)
USE OF EQUIVALENT PORT AND STARBOARD MECHANICAL PROPULSION
ARRANGEMENTS (MS-LTDR) WILL REQUIRE USE OF LEFT AND RIGHT-HAND
GEARS, OR USE OF OPPOSITE-TURNING ENGINES TO OBTAIN OPPOSITE
ROTATION OF PORT AND STARBOARD PROPELLERS.

** WARNING - MACHINERY MODULE ** (W-SHAFTANGLE2LARGE-MHYMSG)
ANGLE OF PORT/INBOARD PROPELLER SHAFT EXCEEDS RECOMMENDED LIMIT.
    MAX REC SHAFT ANGLE, DEG     5.00
    ACTUAL SHAFT ANGLE, DEG      6.25

** WARNING - MACHINERY MODULE ** (W-SHAFTANGLE2LARGE-MHYMSG)
ANGLE OF STBD/INBOARD PROPELLER SHAFT EXCEEDS RECOMMENDED LIMIT.
    MAX REC SHAFT ANGLE, DEG     5.00
    ACTUAL SHAFT ANGLE, DEG      5.00
```

Again pay attention to the parameters that have been given default values to make sure that ASSET is putting in values that are in line with your intended design. In this case, it is clear from the graphic reports and the shaft angle warnings that the machinery is located higher than we would want. We will go back and assign values to the CG parameters. Open the Editor and navigate to the ARRANGEMENT CG folder (**PROPULSION PLANT, ARRANGEMENTS, ARRANGEMENT CG**). Set the MACHY KG IND to **GIVEN**. Open the MAIN ENGINE KG ARRAY. ASSET has given a default value of .45 for both main engines. Set these to **.20**. Select the SS ENGINE KG ARRAY. ASSET has given a default value of .4 for both SS engines. Set these to **.15**. **Close** the Editor and save your changes. Run the Machinery Module again. ASSET returns the following:

```
C,M>RUN, MACHINERY MODULE
 ** WARNING - MACHINERY MODULE ** (W-DEFAULTVALUES-MHYMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     PD SS ADJ FAC ARRAY

 ** WARNING - MACHINERY MODULE ** (W-TEMPVALUES-MHYMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED TEMPORARY VALUES:
     SHIP EHP EXPNT ARRAY

 ** WARNING - MACHINERY MODULE ** (W-GRPITCHLINEVEL-G01SIZ)
 PITCH LINE VELOCITY FOR INPUT PINION OF GEAR  1 EXCEEDS LIMIT.
 GEAR FACE WIDTH OR K FACTOR SHOULD BE INCREASED.
     ACTUAL VELOCITY, M/SEC     107.58
     LIMITING VELOCITY, M/SEC   101.50

 ** WARNING - MACHINERY MODULE ** (W-ENGSEPNOTOK4GR-G01SIZ)
 ACTUAL SEPARATION OF ENGINE CENTERLINES IS NOT WITHIN
 ALLOWABLE BOUNDS FOR GEARBOX.
     MIN ALW SEP, M               3.26
     MAX ALW SEP, M               4.08
     ACTUAL  SEP, M                2.02

 ** WARNING - MACHINERY MODULE ** (W-TORQGOVRNSHDIA-SHSIZO)
 PROPELLER SHAFT DIAMETER IS GOVERNED BY TORQUE.

 ** WARNING - MACHINERY MODULE ** (W-MRDIM2SMALL-MRDIMR)
 DIMENSIONS OF THE FOLLOWING MACHINERY ROOMS ARE TOO SMALL
 TO ENCLOSE MACHINERY : 1, 3

 ** WARNING - MACHINERY MODULE ** (W-LEFTRIGHTGEARREQ-MHYMSG)
 USE OF EQUIVALENT PORT AND STARBOARD MECHANICAL PROPULSION
 ARRANGEMENTS (MS-LTDR) WILL REQUIRE USE OF LEFT AND RIGHT-HAND
 GEARS, OR USE OF OPPOSITE-TURNING ENGINES TO OBTAIN OPPOSITE
 ROTATION OF PORT AND STARBOARD PROPELLERS.
```

You can see in the graphic reports that the machinery is at a much more reasonable level and we are no longer getting the shaft angle warnings. Following the successful run of this module, save the ship to the databank (**Ship, Modify**). The Machinery Module summary printed report and first graphics report follow. Note that ASSET makes no attempt to rout the intake and exhaust ducting around the flight deck.

ASSET/MONOCV VERSION 4.3.0 - MACHINERY MODULE - 8/11/98 10:41.58
GRAPHIC DISPLAY NO. 1 - SHIP MACHINERY LAYOUT




ASSET/MONOCV VERSION 4.3.0 - MACHINERY MODULE - 8/10/98 11:40.33
PRINTED REPORT NO. 1 - SUMMARY

| | | | |
|---|---|---|---|
| TRANS TYPE IND | MECH | MAX SPEED, KT | 26.04 |
| ELECT PRPLN TYPE IND | | SUSTN SPEED IND | GIVEN |
| SHAFT SUPPORT TYPE IND | OPEN STRUT | SUSTN SPEED, KT | 26.00 |
| NO PROP SHAFTS | 2. | SUSTN SPEED POWER FRAC | .800 |
| SEC ENG USAGE IND | AND | ENDUR SPEED IND | GIVEN |
| SS SYS TYPE IND | PD | ENDUR SPEED, KT | 20.00 |
| PD SS TYPE IND | STEAM | DESIGN MODE IND | ENDURANCE |
| MAX MARG ELECT LOAD, KW | 7869. | ENDURANCE, NM | 8000. |
| AVG 24-HR ELECT LOAD, KW | 4129. | USABLE FUEL WT, MTON | 3191.0 |
| SWBS 200 GROUP WT, MTON | 896.3 | SWBS 300 GROUP WT, MTON | 1179.1 |
| NO BOILERS PER SHAFT | 1. | NO RESERVE BOILERS | 0. |
| AUX STEAM FAC | 1.250 | | |

| ARRANGEMENT OR SS SYSTEM | TYPE | NO INSTALLED | NO ONLINE MAX+SUSTN | NO ONLINE ENDURANCE |
|---|---|---|---|---|
| MECH CL/PORT ARR IND | MS-LTDR | 1 | 1 | 1 |
| MECH STBD ARR IND | MS-LTDR | 1 | 1 | 1 |
| SEP SHIP-SERVICE SYSTEM | 2000. KW | 4 | 3 | 3 |
| PD SHIP-SERVICE SYSTEM | 2000. KW | 2 | 2 | 2 |

| | MAIN ENG | SEC ENG | SS ENG |
|---|---|---|---|
| ENG SELECT IND | GIVEN | GIVEN | GIVEN |
| ENG MODEL IND | OTHER | OTHER | F 38TD8-1/8-12 |
| ENG TYPE IND | 1200 ST | 1200 ST | D DIESEL |
| ENG SIZE IND | CALC | CALC | GIVEN |
| NO INSTALLED | 2 | 2 | 4 |
| ENG PWR AVAIL, KW | 1196. | 8569. | 2610. |
| ENG RPM | 29960.7 | 7186.5 | 900.0 |
| ENG SFC, KG/KW-HR | .289 | .289 | .201 |
| ENG LOAD FRAC | 1.000 | 1.000 | .797 |

## Section 7.16 – WEIGHT MODULE

Run the weight module (**Module, Run, WEIGHT MODULE, Ok**). This module calculates a detailed weight breakdown for the ship.

ASSET returns the following:

```
C,M>RUN, WEIGHT MODULE
 ** FATAL ERROR - WEIGHT MODULE ** (E-NOW100KYPARSWBS-PFCHEK)
 A W100 KEY MUST BE ENTERED IN THE PARENT SWBS KEY TBL.
```

Open the Editor and use the Find tool to go to the PARENT SWBS KEY TBL. For the first value of the PARENT SWBS KEY TBL select W100, then for the first entry of the PARENT SHIP ID TBL select CV EQNS. The W100 key serves as the default value for all of the SWBS numbers. Run the Weight Module again.

```
C,M>RUN, WEIGHT MODULE
 ** WARNING - WEIGHT MODULE ** (W-DEFAULTVALUES-WT1MPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     GROWTH WT MARGIN                   GROWTH KG MARGIN FAC
     PD WT MARGIN FAC                   PD KG MARGIN FAC
     CD WT MARGIN FAC                   CD KG MARGIN FAC
     D+B WT MARGIN FAC                  D+B KG MARGIN FAC
     CON MOD WT MARGIN FAC              CON MOD KG MARGIN FAC
     GFM WT MARGIN FAC                  GFM KG MARGIN FAC
     PARENT SHIP OUTPUT IND
```

The input for the module is complete. The Weight Module has defaulted several parameters. You should verify that these are appropriate for your design. The Weight Module Summary printed report follows.

ASSET/MONOCV VERSION 4.3.0 - WEIGHT MODULE - 8/10/98 11:56.20

PRINTED REPORT NO. 1 - SUMMARY

| SWBS | G R O U P | W E I G H T MTON | PER CENT | LCG M | VCG M |
|---|---|---|---|---|---|
| 100 | HULL STRUCTURE | 40940.4 | 59.5 | 133.86 | 12.92 |
| 200 | PROPULSION PLANT | 896.3 | 1.3 | 163.30 | 5.73 |
| 300 | ELECTRIC PLANT | 1179.1 | 1.7 | 136.29 | 12.59 |
| 400 | COMMAND + SURVEILLANCE | 615.0 | .9 | 148.83 | 25.41 |
| 500 | AUXILIARY SYSTEMS | 5545.1 | 8.1 | 121.16 | 17.07 |
| 600 | OUTFIT + FURNISHINGS | 3192.1 | 4.6 | 129.44 | 17.83 |
| 700 | ARMAMENT | 478.3 | .7 | 134.16 | 9.30 |
| | L I G H T S H I P | 52846.3 | 76.8 | 132.99 | 13.64 |
| M21 | PD MARGIN (WT = 2.4%) | +1268.3 | | (KG = 2.4%) | + .33 |
| M22 | CD MARGIN (WT = 2.4%) | +1298.8 | | (KG = 2.4%) | + .34 |
| M11 | D & B MARGIN (WT = 5.3%) | +2936.9 | | (KG = 5.3%) | + .76 |
| M23 | CON MOD MARGIN (WT = 1.4%) | + 775.8 | | (KG = 1.4%) | + .20 |
| M24 | GFM MARGIN (WT = .6%) | + 332.5 | | (KG = .6%) | + .09 |
| | LIGHT SHIP WITH MARGINS | 59458.5 | 86.4 | 132.99 | 15.34 |
| F00 | FULL LOADS | 9355.9 | 13.6 | 127.04 | 4.79 |
| F10 | SHIPS FORCE + EFFECTS | 371.5 | | 156.10 | 18.09 |
| F20 | MISSION RELATED EXPENDABLES | 702.4 | | 122.24 | 8.29 |
| F30 | SHIPS STORES | 956.1 | | 129.50 | 12.99 |
| F40 | FUELS + LUBRICANTS | 6723.5 | | 124.99 | 2.75 |
| F50 | LIQUIDS + GASES (NON FUEL) | 602.3 | | 133.67 | 2.27 |
| F60 | CARGO | .0 | | .00 | .00 |
| | F U L L L O A D W T | 68814.4 | 100.0 | 132.18 | 13.91 |

## Section 7.17 – SPACE MODULE

Run the Space module (**Module, Run, SPACE MODULE, Ok**). This module calculates the total area and volume requirements of the ship.

ASSET returns the following:

```
C,M>RUN, SPACE MODULE

 ** WARNING - SPACE MODULE ** (W-DEFAULTVALUES-SPCMPL)
 THE FOLLOWING PARAMETERS WERE PROVIDED DEFAULT VALUES:
     SONAR AREA ARRAY                   SONAR AREA ARRAY
     SPACE MARGIN FAC                   PASSWAY MARGIN FAC
     TANKAGE MARGIN FAC
```

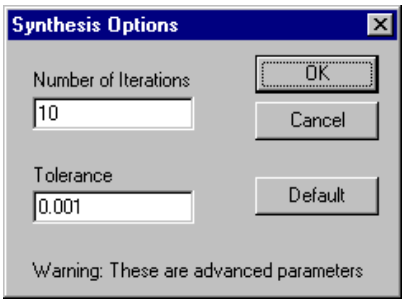
Your design should have a space and tankage margin factor of 0.05. Read the on-line help for clarification of the SPACE MARGIN FAC and TANKAGE MARGIN FAC parameters. Set both of these parameters to 0.05 and run the Space module again. After the successful run of this module, save the ship to the databank (**Ship, Modify**). Following is the summary printed report.

```
ASSET/MONOCV VERSION 4.3.0 - SPACE MODULE -   8/10/98 11:59.46

 PRINTED REPORT NO.  1 - SUMMARY

 SHIP TYPE-CARRIER                      AVIATION FACILITY-MAJOR AVN
 COLL PROTECT SYSTEM-PRESENT            HAB STANDARD-NAVY
 SONAR DOME-NONE                        EMBARKED COMMANDER-FLAG CMDR

 FULL LOAD WT, MTON        68814.4
 TOTAL CREW ACC              3536.     PASSWAY MARGIN FAC           .000
 HULL AVG DECK HT, M          3.54
 MR VOLUME, M3              11447.     SPACE MARGIN FAC             .050
 TANK VOL REQ,M3            14031.     TANK MARGIN FAC              .050
 SHAFT ALLEY VOLUME,M3          0.

                                     AREA M2                     VOL M3
                          PAYLOAD     TOTAL        TOTAL          TOTAL
                          REQUIRED   REQUIRED    AVAILABLE        ACTUAL
                          --------   --------    ---------       --------
 DKHS ONLY                      0.       581.       1056.           2639.
 HULL OR DKHS                 477.     54643.      50506.         204857.
 SPONSON                                           14111.          44636.
                          --------   --------    ---------       --------
 TOTAL                        477.     55224.      65673.         252132.

                                TOTAL     DKHS     PERCENT
 SSCS    GROUP                 AREA M2   AREA M2   TOTAL AREA
 -------------                 --------  --------  ----------
  1. MISSION SUPPORT             16296.      271.     29.5
  2. HUMAN SUPPORT               19871.      139.     36.0
  3. SHIP SUPPORT                13054.       19.     23.6
  4. SHIP MOBILITY SYSTEM         3373.      125.      6.1
  5. UNASSIGNED                  2629.7      27.7      4.8
                                --------  --------  ----------
                  TOTAL          55224.      581.    100.0
```

## Section 7.18 – DESIGN SYNTHESIS

With the completion of the Space module, you are now ready to send your model to synthesis. Here, ASSET will alter design parameters until your model is coherent in all respects. Before you begin, there are a few items you will need to check.

From the menu select **Module** and **Synthesis**. Click on the **Options** button on the pop-up form.




With this dialogue box you are able to set the number of iterations in the synthesis loop. If you select a smaller tolerance, ASSET will need more iterations to converge the model. Set the iterations to **15**. Press the OK button.

Run synthesis by pressing the YES button on the RUN SYNTHESIS dialogue. After you issue this command, ASSET begins the synthesis process.

You should note that when running synthesis, BEAM will be changed to provide the specified GMT/B REQ and required arrangeable area.

Most ships should converge in about 6 to 8 iterations. If the model has not converged after 15 iterations, run synthesis again. If the model has not converged in 30 iterations, the hull geometry is probably oscillating between two very close configurations.

The primary hull geometry culprit for oscillation is BEAM. The BEAM is adjusted to satisfy the GMT/B REQ. However, BEAM affects several parameters that affect the KG which in turn affects GMT. A subtle shift in BEAM can produce a big enough change in KG that the change in GMT

exceeds the synthesis tolerance. Then the Hull Geometry Module to satisfy the GMT/B REQ may reverse the previous adjustment to BEAM. For example, let's assume that in the current iteration the GMT/B is too high. To correct this the Hull Geometry Module will decrease BEAM. Generally this will result in a proportionally higher reduction in KMT and therefore a reduction in GMT/B, assuming KG is unchanged. However, the reduction in BEAM may allow the Hull Structure Module to reduce the thickness of the bottom shell plating. This will result in an increase in KG and may cause the GMT/B to be lower than required. On the next synthesis iteration, the Hull Geometry Module will increase BEAM to satisfy the GMT/B REQ. Then the Hull Structure Module due to the increased BEAM may increase the thickness of the bottom shell plating, resulting in a decrease in KG. If the newly calculated BEAM and resulting KG are close to the values obtained two iterations before, an oscillation has begun.

If you suspect an oscillation in hull geometry, set the number of synthesis iterations to 1. Then RUN SYNTHESIS. By checking BEAM and other characteristics after each of several runs through synthesis you can determine if an oscillation is occurring and the range of oscillation.

To correct for a failure to converge due to oscillation, change the HULL DIM IND to eliminate the variable from the hull geometry calculations and set the hull geometry within the range of the oscillation. Thus if BEAM is oscillating, set the HULL DIM IND value to NONE and set BEAM to a reasonable value within the oscillation range. Generally this range is extremely small. After fixing the hull geometry, the synthesis module should be able to converge the model.

After the synthesis converges, ASSET returns with a message similar to the following.

```
   CONVERGENCE ACHIEVED IN 11 ITERATIONS FOR THE FOLLOWING SYNTHESIS LOOP:
BEGINNING MODULE  =  HULL GEOM MODULE
ENDING MODULE    =  DESIGN SUMMARY
```

The synthesis process is complete. Your model has been converged to the set tolerance. At this point you should go back and review your model. It is also a good time to MODIFY your ship in the attached data bank.

To generate data on your new model, set the desired printed and graphic reports to be generated by ASSET. For each report selected, run the corresponding module to produce the report. A good summary of your model is generated by the Design Summary Module Printed Report No. 1.

Another informative report is the Summary Report generated by the Hull Geometry Module. This report shows the Stability Beam (the beam required to satisfy the GMT/B REQ) and the AREA BEAM (the beam required to provide the required arrangeable area). An objective of any design should be to make the Stability Beam and the AREA BEAM be as close to equal as possible. A copy of the Design Summary and Hull Geometry summary reports follow.

```
      ASSET/MONOCV VERSION 4.3.0 - DESIGN SUMMARY -   8/11/98 13:47.11

 PRINTED REPORT NO. 1 - SUMMARY

 SHIP COMMENT TABLE

   PRINCIPAL CHARACTERISTICS - M            WEIGHT SUMMARY - MTON
 LBP                          259.0     GROUP 1 - HULL STRUCTURE  41059.0
 HULL LOA                     271.1     GROUP 2 - PROP PLANT       2041.5
 BEAM, DWL                     37.0     GROUP 3 - ELECT PLANT      1153.6
 BEAM, WEATHER DECK            37.0     GROUP 4 - COMM + SURVEIL    606.8
 DEPTH @ STA 10                26.7     GROUP 5 - AUX SYSTEMS      6075.1
 DRAFT TO KEEL DWL             12.0     GROUP 6 - OUTFIT + FURN    3231.0
 DRAFT TO KEEL LWL             12.0     GROUP 7 - ARMAMENT          478.2
 FREEBOARD @ STA 3             15.9     ----------------------------------
 GMT                            2.8     SUM GROUPS 1-7            54645.2
 CP                            .640     DESIGN MARGIN              6837.3
 CX                            .980     ----------------------------------
                                        LIGHTSHIP WEIGHT          61482.5
 SPEED(KT):  MAX= 27.0  SUST= 26.0      LOADS                     12684.6
 ENDURANCE:  8000.0 NM AT 20.0 KTS      ----------------------------------
                                        FULL LOAD DISPLACEMENT    74167.1
 TRANSMISSION TYPE:            MECH     FULL LOAD KG:  M             13.3
 MAIN ENG: 2 1200 ST  @  4555.6 KW
 SEC ENG:  2 1200 ST  @ 32652.6 KW      MILITARY PAYLOAD WT- MTON  4429.6
 SHAFT POWER/SHAFT:      37208.2 KW     USABLE FUEL WT - MTON      5857.4
 PROPELLERS: 2 - FP  -  6.1 M  DIA

 SEP GEN:  4 D DIESEL @  2000.0 KW
 PD GEN:   2 STEAM    @  2000.0 KW
                                                 OFF  CPO   ENL    TOTAL
 24-HR LOAD                  4585.6     MANNING   306  174  2729     3209
 MAX MARG ELECT LOAD         8451.9     ACCOM     338  194  3004     3536

      AREA SUMMARY - M2                      VOLUME SUMMARY - M3
 HULL AREA             -     42729.     HULL VOLUME           -    191171.
 SPONSON AREA          -     14222.     SPONSON VOLUME        -     44982.
 SUPERSTRUCTURE AREA   -       988.     SUPERSTRUCTURE VOLUME -      2468.
 ----------------------------------     ----------------------------------
 TOTAL AREA            -     57938.     TOTAL VOLUME            -    238621.


ASSET/MONOCV VERSION 4.3.0 - HULL GEOM MODULE -   8/11/98 13:46.53

 PRINTED REPORT NO.  1 - HULL GEOMETRY SUMMARY

 HULL OFFSETS IND-GENERATE              MIN BEAM, M                 48.07
 HULL DIM IND-T                         MAX BEAM, M                 45.72
 MARGIN LINE IND-CALC                   HULL FLARE ANGLE, DEG         .00
 HULL STA IND-OPTIMUM                   FORWARD BULWARK, M           1.22
 HULL BC IND-CV
 FAST SHIP PARENT IND-

                   HULL PRINCIPAL DIMENSIONS (ON DWL)
                   ==================================
 LBP, M                      259.00     PRISMATIC COEF               .640
 HULL LOA, M                 271.07     MAX SECTION COEF             .980
 BEAM, M                      37.00     WATERPLANE COEF              .773
 BEAM @ WEATHER DECK, M       37.00     LCB/LBP                      .520
 DRAFT, M                     11.99     HALF SIDING WIDTH, M          .30

 DEPTH STA 0, M               26.66     BOT RAKE, M                   .00
 DEPTH STA 3, M               26.66     RAISED DECK HT, M             .00
 DEPTH STA 10, M              26.66     RAISED DECK FWD LIM, STA
 DEPTH STA 20, M              26.66     RAISED DECK AFT LIM, STA
 FREEBOARD @ STA 3, M         15.89     BARE HULL DISPL, MTON    73858.59

 STABILITY BEAM, M            39.11     AREA BEAM, M                37.00

       BARE HULL DATA ON LWL                  STABILITY DATA ON LWL
       =====================                  =====================
 LGTH ON WL, M               259.00     KB, M                         6.57
 BEAM, M                      37.00     BMT,  M                       9.55
```

```
DRAFT, M                    11.98     KG,  M                      13.32
FREEBOARD @ STA 3, M        15.90     FREE SURF COR, M              .00
PRISMATIC COEF               .639     SERV LIFE KG ALW, M           .00
MAX SECTION COEF             .982
WATERPLANE COEF              .772     GMT, M                       2.79
WATERPLANE AREA, M2       7402.26     GML, M                     380.61
WETTED SURFACE, M2       11239.40     GMT/B AVAIL                  .076
                                      GMT/B REQ                    .100
BARE HULL DISPL, MTON    73901.45
APPENDAGE DISPL, MTON      257.58
FULL LOAD WT, MTON       74158.30
```

Run the other synthesis modules to note any warning messages and to check that your design configuration is as you intended.

The next step in the design process is to identify areas in the design that need refinement. The next section in the tutorial addresses some typical design refinements.