

CAD/CAM System N-Ship+
Version 5.0

Module Model
Work with ship geometrical model

User manual

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ANNOTATION

The document is a reference manual for work with the module **Model** of the **N-Ship+** system. The manual includes description of menu, commands, user interface, themes of interaction with other modules of the system.

Document is designed for specialists who run **N-Ship+** system for the design and technological preparation of the ship hull production and have practical experience of using nanoCAD graphical system. **N-Ship+** is informationally compatible with the systems **Ritm-Ship** (AutoCAD), **R-Ship+** (AutoCAD), **N-Ship+** (nanoCAD).

Recommended operating systems are: Windows 8.1, Windows 10.

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1. GENERAL INFORMATION

Module **Model** is designed for running basic operations on forming, tuning and adapting geometric model having structure used by **N-Ship+** system (hull forms are main objects in the model). Module has logical connections with modules **Structure**, **Part** and **Mdet**.

1.1. Terms and agreements

This guide uses the following font agreements:

Italic – names of folders, files and extensions, additional text to graphical editor requests in commands;

Bold – names of modules and system components, menus, items, buttons and keys, commands in the dialog with graphical editor;

CAPITAL – names of layers, software commands and named objects.

Message texts in the described commands are emphasized with blue color.

For shortness everywhere in the document system N-Ship+ will be named N-Ship.

1.2. User interface

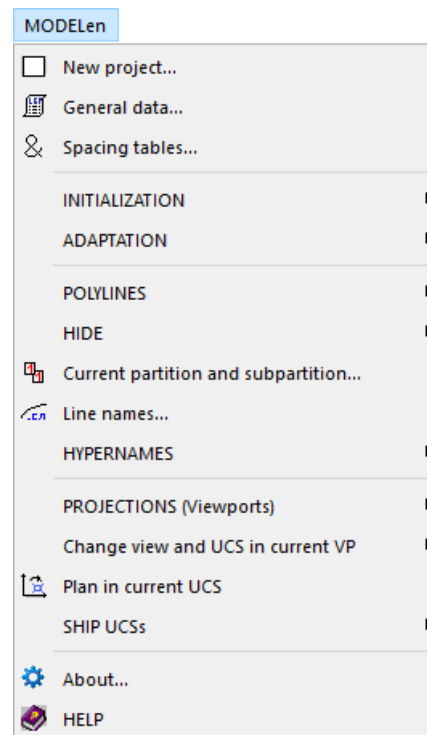
N-Ship includes drop-down (pull-down) menus containing commands of system modules. Ribbon is not used.

Module **Model** requires pull-down menu **MODEL**, which name consists from MODEL and two-symbols suffix denoting current localization language: **MODEL_{en}** (English), **MODEL_{ru}** (Russian), etc. (dr. 1). But for universality everywhere in the document **MODULE** name is used instead of MODEL_{en}, MODEL_{ru}.

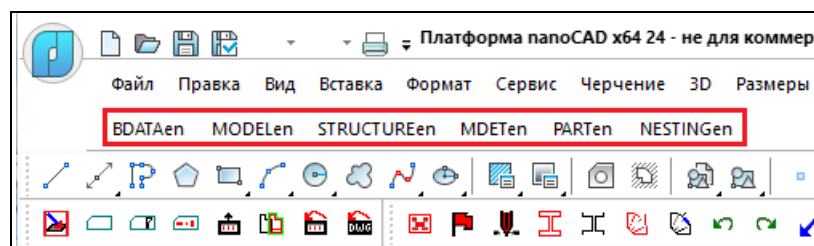
Loading MODEL menu is described in administrator manual (N-Admim_en.pdf). Dr.2 shows menu line with loaded N-Ship English pull-down menus

Full set of module commands is also accessible from the toolbars: **Model**, **Projections** and **Polylines** (dr. 3).

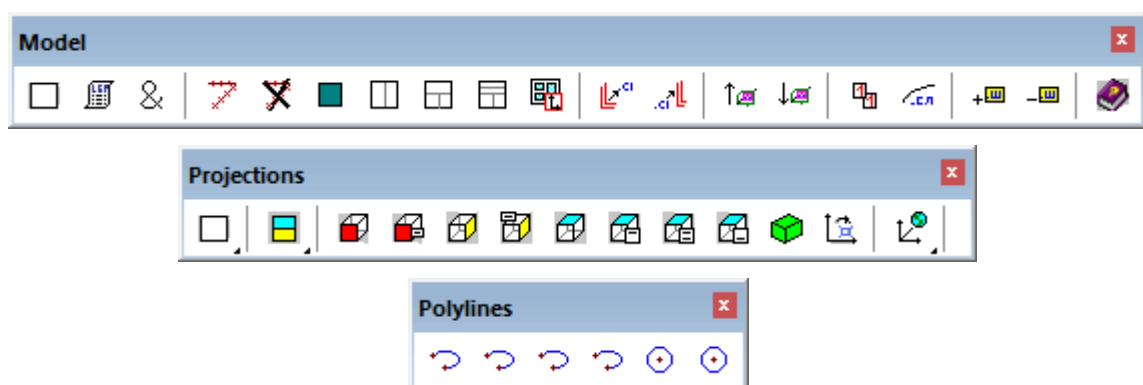
Note. For changing user interface language one can apply menu command **BDATA > UI language**.



Drawing 1. Drop-down menu **MODEL**



Drawing 2. Loaded menus of N-Ship



Drawing 3. Toolbars

2. DESIGN DATA

Module **Model** works with projects having special organization of files and folders.

2.1. Project files organization

Each project has its own folder. Folder name is equal to project name (number), it must support the following naming restrictions:

- project name length does not exceed 8 (symbols);
- project name consists from digits and latin letters only (lowercase and uppercase do not differ); no spaces allowed.

Any project folder must be located inside the N-Ship projects folder (usually *NSHIP\Projects*). During N-Ship installation path to projects folder is saved in Windows registry, in parameter *projectsnano*. Folders residing inside the projects directory and violating naming restrictions are ignored by the software.

The following files can be located in project folder:

- DWG files of models (model names have no restrictions);
- textual file *project.par*, containing project general parameters and some data from the active model;
- spacing table files with names *<N>.&sp*, *<N>.&st*, *<N>.&bp*, *<N>.&wp*, where *<N>* represents project name (e.g. *71144.&sp*); they contain spacing data for frames, design sections, buttocks, waterlines.


Folder *Steel* can be located inside the projects folder (for data and results of module **Structure**).

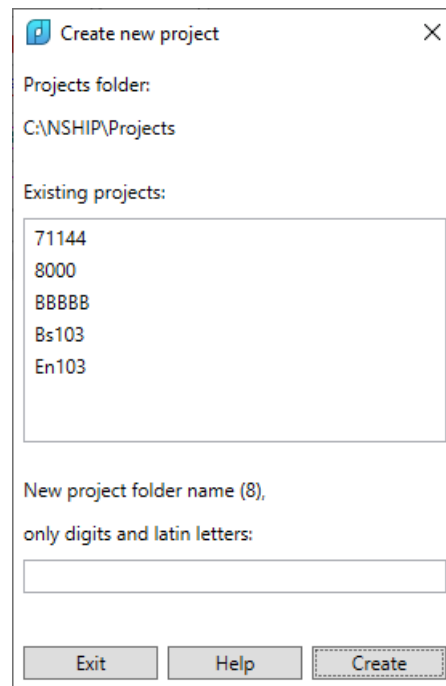
There are special commands for creation and initialization of project, they can do the following actions:

- create project folder, file *project.par* and spacing files with default data (see par. 2.2);
- edit general parameters file *project.par* for project data (see par. 2.3);
- edit spacing tables (see par. 2.4);
- initialize DWG file of future ship geometric model (create axes, views, viewports and USCs, see par. 4.1).

Note. Geometric model can be divided between several DWG files (e.g. by blocks, portions or sections).

2.2. New project

To create new project folder inside system projects folder, with file of general parameters and spacing files with default data, call menu command **MODEL > New project** or button  from toolbar **Model**. Command opens dialog box **Create new project** (dr. 4).




Drawing 4. Dialog box **Create new project**

Name of new project must be entered in the field **New project folder name (8)**. Number in brackets (8) means maximum quantity of symbols in the name. After clicking button **Create** project folder will be created if name has no errors. Symbols different from digits and latin letters cause error.

2.3. General parameters

File *project.par* contains general data of the project ship (length, width, draft, sternframe line layer name, stemframe line layer name, abscissae axis direction, etc.).

Editing general parameters file can be done in the dialog box **General project parameters** (dr. 5) being opened by command **MODEL > General parameters** or with button  of toolbar **Model**.

In the upper part there are two descriptive parameters: **Ship type** and **Designer**. In the middle part there are the following data (square brackets show allowed values in meters):

LMAX — length maximal, [1.0, 999.0];

LPP — length between perpendiculars, [1.0, 999.0]. Referenced in design sections spacing table;

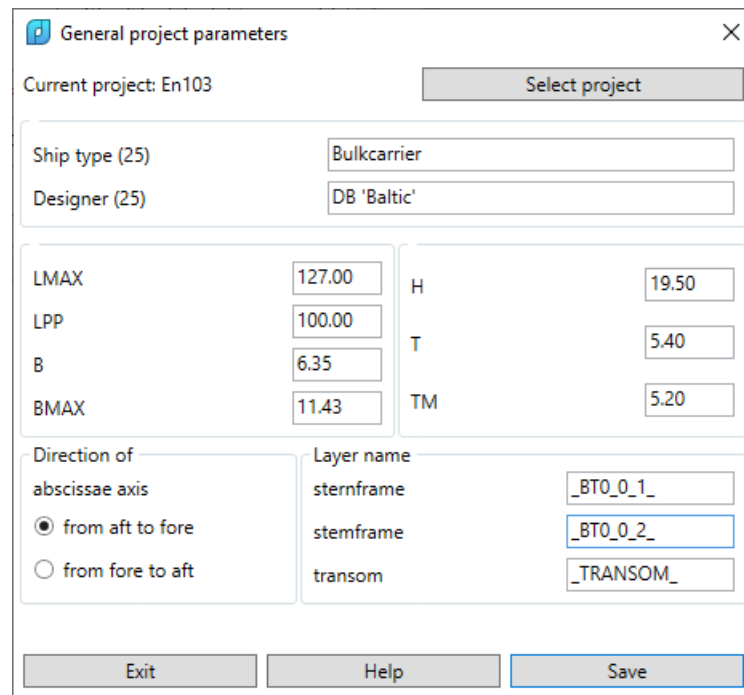
B — width, [1.0, 199.0];

BMAX — width maximal, [1.0, 199.0];

H — height, [1.0, 199.0];

T — draft, [0.1, 99.0];

TM — draft on middle frame, [0.1, 99.0].



General project parameters

Current project: En103 Select project

Ship type (25) Bulkcarrier

Designer (25) DB 'Baltic'

LMAX	127.00	H	19.50
LPP	100.00	T	5.40
B	6.35	TM	5.20
BMAX	11.43		

Direction of abscissae axis

☒ from aft to fore

☐ from fore to aft

Layer name

sternframe	_BT0_0_1_
stemframe	_BT0_0_2_
transom	_TRANSOM_

Exit Help Save

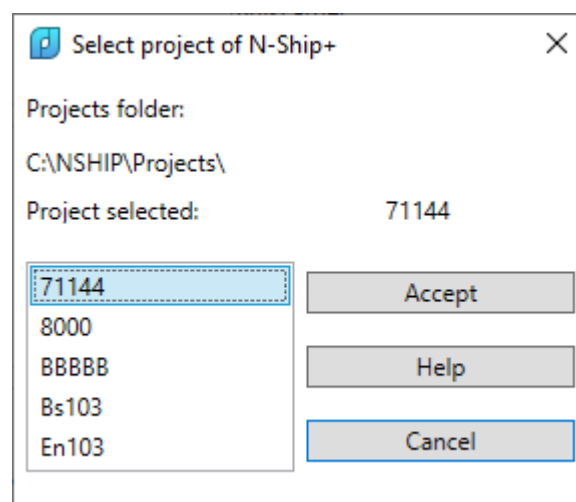
Drawing 5. Dialog box **General project parameters**

In the area **Direction of abscissae axis** it is necessary to choose type of increasing frames numeration: **from aft to fore** or **from fore to aft**.

Area **Layer name** contains three important parameters: **sternframe**, **stemframe** and **transom**. On these layers three important forming lines are located, they are used by module **Structure**.

Pressing button **Save** runs saving operation to the file *project.par* and does not close the window, giving opportunity to continue work with other project parameters. Clicking **Exit** closes window.

Button **Select project** is targeted to go to other project and to edit its general parameters. Button opens auxiliary window **Select project** (dr. 6).



Select project of N-Ship+

Projects folder:
C:\NSHIP\Projects\

Project selected: 71144

71144	Accept Help Cancel
8000	
BBBBB	
Bs103	
En103	

Drawing 6. Dialog box **Select project**


User must choose project name and press button **Accept**. In the dialog box **General project parameters** all the fields will get values from selected project.

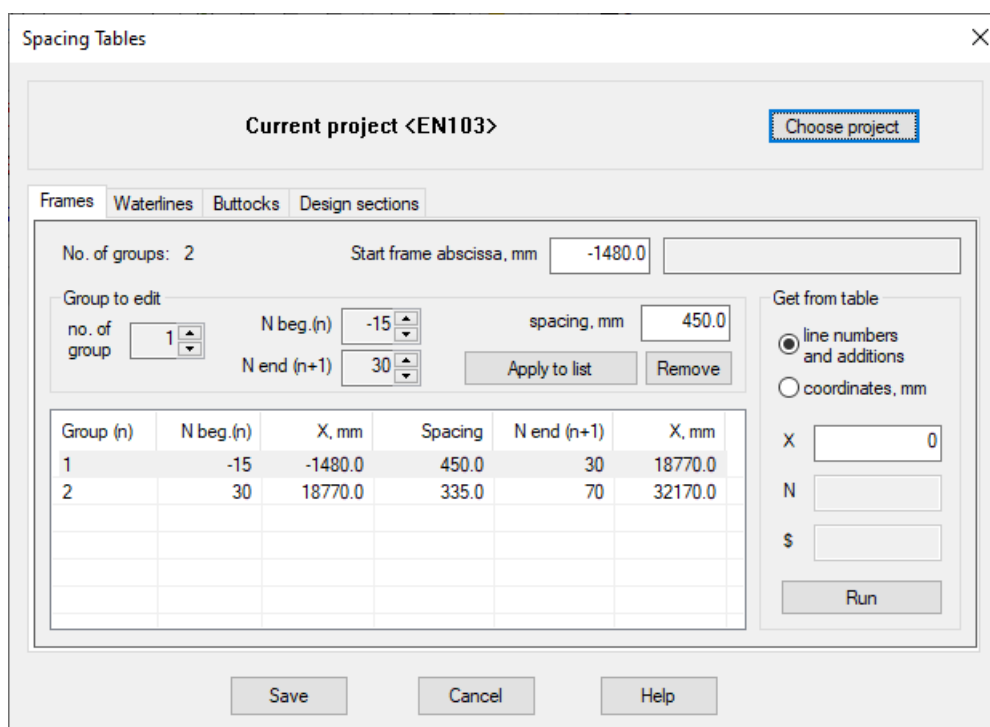
2.4. Spacing tables

2.4.1. Spacing table files

Each project folder must contain four files of spacing tables. Names of these files are created from the project name and extensions **.&sp**, **.&st**, **.&bp**, **.&wp**, for example: *13750.&sp*, *911.&wp*, etc. Spacing table files are as follows:

- frames table (extension **.&sp**),
- design sections table (extension **.&st**),
- buttocks table (extension **.&bp**),
- waterlines table (extension **.&wp**).

Filling in and editing spacing tables can be done in the dialog box **Spacing Tables** (dr. 7), that is opened with **MODEL > Spacing tables** or with button  of the toolbar **Model**.



Spacing Tables

Current project <EN103> Choose project

Frames Waterlines Buttocks Design sections

No. of groups: 2 Start frame abscissa, mm -1480.0

Group to edit
no. of group 1 N beg.(n) -15 spacing, mm 450.0
N end (n+1) 30 Apply to list Remove

Get from table
☒ line numbers and additions
☐ coordinates, mm

Group (n)	N beg.(n)	X, mm	Spacing	N end (n+1)	X, mm
1	-15	-1480.0	450.0	30	18770.0
2	30	18770.0	335.0	70	32170.0

X 0
N
\$
Run

Save Cancel Help

Drawing 7. Dialog box **Spacing Tables**

Dialog box **Spacing Tables** is divided into three zones:

- zone with current project name and button **Choose project**;
- zone with four table tabs (frames, waterlines, buttocks and design sections);
- zone with buttons **Save**, **Cancel** and **Help**.

Zone with project name shows number of the project which spacing data are displayed in table tabs (this is the current project name in N-Ship or project name chosen before in the window

Spacing Tables). Step of changing project or creating new project with the button **Choose project** is discussed in par.2.4.2.

Central part of dialog **Spacing Tables** is occupied with zone of four tabs for selected project: **Frames**, **Waterlines**, **Buttocks** and **Design sections**. By default tab **Frames** is active. To edit spacing tables (including tables for new project) it is necessary to activate each tab one by one and insert in it all the required changes. After that button **Save** must be clicked to save new data to the spacing table files of the project.

Structure of all tabs is similar, there are differences in names of some parameters, for example: **Start frame abscissa**, **Start waterline applicate**, **Start buttock ordinate**. Each tab can be divided into four logical units:

- upper part (parameters **No. of groups** and **Start frame abscissa**, mm as well as line for error messages);
- area **Group to edit**;
- tabular list with data of all the spacing groups for the current table;
- area **Get from table**.

The main logical unit of the opened tab is left-bottom located tabular list (dr. 8). It reflects state of the current spacing table (distance table). From these four tabs all the changed data will be written to current project files on disk after pressing button **Save** of the dialog **Spacing Tables**.

Group (n)	N beg.(n)	X, mm	Spacing	N end (n+1)	X, mm
1	-15	-1480.0	450.0	30	18770.0
2	30	18770.0	335.0	70	32170.0

Drawing 8. Tabular list

Area **Group to edit** displays data of the group selected in the current moment in the tabular list (inside the same group lines have the same distance).

Upper part of the tab contains two parameters. Parameter **No. of groups** shows current quantity of groups in the active tab. Parameter **Start frame abscissa** (**Start waterline applicate**, **Start buttock ordinate**) shows value of the start (zero) line coordinate in the current spacing table. That is the line from which other lines using spacing are positioned (frames, waterlines, buttocks, depending on the table kind being active).

Each tab of the dialog box **Spacing Tables** can be used for two operations:

- editing table;
- calculation from the table.

After editing table and adding new data pressing button **Save** writes new data of all the four tables on disk and closes dialog box **Spacing Tables**. Before saving a request is displayed. See par. 2.4.3 for more details about editing tables.

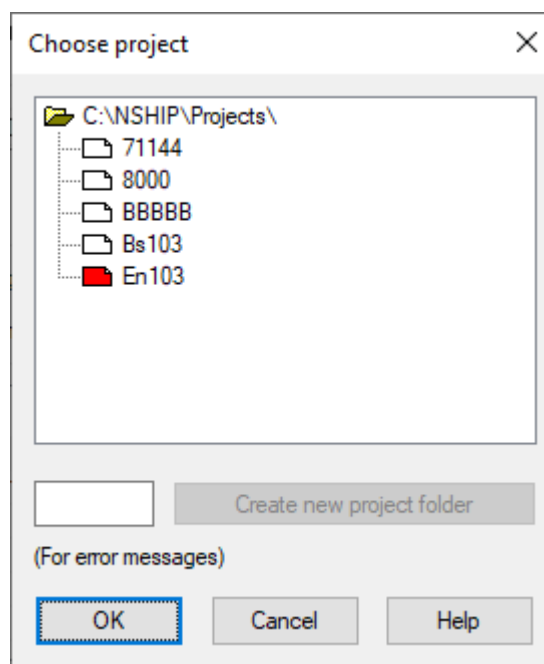
Area **Get from table** allows to make calculations based on current tabular list (even it has not yet been saved in files on disk). Two kinds of calculation are possible: line coordinates by number and addition; line number and addition by line coordinate. As for line coordinate it is frame abscissa, or waterline height, or buttock halfbreadth. More about calculations in table see par. 2.4.4.

To exit from the dialog box without saving button **Cancel** is used. In case of using this button warning about losing changes is generated.


Pressing button **Help** opens help topic devoted to work with spacing tables.



2.4.2. Change project

If user needs to work with tables of a different project then in the dialog box **Spacing Tables** he must click on button **Choose project** and in the window **Choose project** (dr. 9) execute operation of changing project.

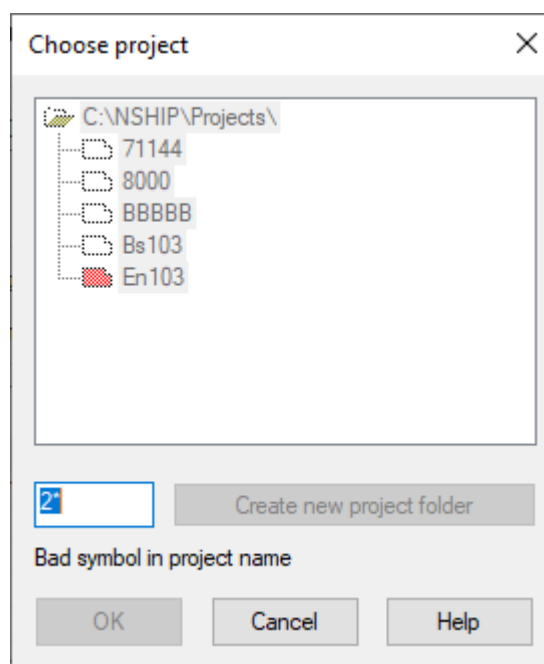


Drawing 9. Dialog box **Choose project**

In the upper part of the window there is a tree of existing project folders (on illustration they are located in *C:\NSHIP\Projects*). Icon  is a mark that this project is current in the dialog box **Spacing Tables**. Under the projects tree there is button **Create new project folder** and edit box for entering project name. Parameter **(For error messages)** is used by the program to display information about errors. Buttons **OK**, **Cancel** and **Help** serve for approval of the new project name, for cancelling change project operation and for calling help topic for the operation.

To go to another project for work with its spacing tables it is necessary to click on the project name or its icon in the tree (icon of the project to become active must change from  to ) , and then to press button **OK**.

In the process of work with dialog box **Choose project** user has an opportunity to create folder for a new project. Project number (name) should be entered in the edit box to the left from button **Create new project folder**. Number must have length from 1 to 8 symbols and consist only from digits and latin letters. Just after you enter the first symbol in the edit box the button **Create new project folder** becomes enabled. If unallowed symbol will be entered then down there will be error message generated (dr. 10). Further work with window **Choose project** is possible only after error correction.



Drawing 10. Message about error in the project name

If newly created project is to become current then user must mark it in the projects tree and click **OK**. Hence program will automatically create spacing files with default data (they are to be edited in the returned window **Spacing Tables**). If user does not mark folder of created project then spacing table files will not be created in the folder.

Button **Cancel** stops operation of changing current project.

2.4.3. Editing spacing tables of selected project

To start editing required spacing table of the current order user must click on this table tab (one of four). After selection the tab data may be changed. On dr. 11 there is tab **Waterlines** with data on distances between waterlines (data are saved in the file with extension .&wp).

Group (n)	N beg.(n)	Z, mm	Spacing	N end (n+1)	Z, mm
1	0	0.0	1000.0	19	19000.0
2	19	19000.0	500.0	22	20500.0

Drawing 11. Waterlines spacing table is loaded

Just after loading tables data the tabular list in the lower part of the tab displays current state of the active tab table. Upper zone shows number of groups and coordinate value (of abscissa, ordinate or applicate) for the starting line in the table. Area **Group to edit** displays data of the spacing group, that is selected in the tabular list (its number is shown in the counter **no. of group**). By default at the first moment number of selected group is set to 1.

If the same spacing value is valid for all the ship project then the tabular list will have only one group (for design sections table it is mandatory). If spacing (increment) varies in different ship regions then other spacing groups must be created.

Each group is bounded with numbers of boundary lines (e.g. aft frame and fore frame). Numbers of lines increase with increasing coordinates (abscissae, ordinates or applicates). End boundary number of the group becomes automatically number of the next group initial boundary line. In the area **Group to edit** and in the tabular list begin and end numbers are named **N beg.(n)** and **N end (n+1)**. Between these lines (frames, waterlines, buttocks) spacing value is constant.

To edit all the spacing table user must select required group (either clicking on the corresponding line in the tabular list or changing counter **no. of group**), change its data in the fields **spacing, mm** and counters **N beg.(n)** and **N end (n+1)**. After changing these data user must click button **Apply to list** to send them in the tabular list. Only from the tabular lists of all the four tabs data can be saved to current project spacing files on disk with button **Save**.

If it is necessary to reduce quantity of groups then select required line and click button **Remove**.

To add a new group user must increase by 1 maximum value in the counter **no. of group**. Under the counter there will appear message **new!** (dr. 12).

No. of groups: 2 Start frame abscissa, mm -1480.0

Group to edit

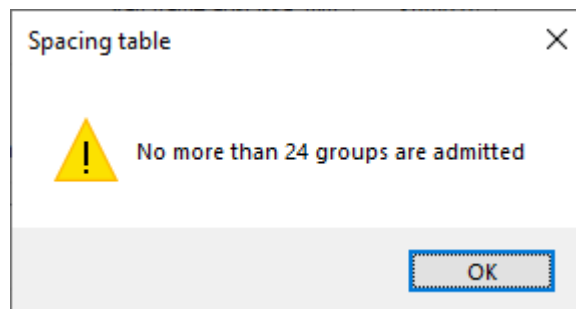
no. of group 3 new! N beg.(n) 70 spacing, mm 500.0

N end (n+1) 71 Apply to list Remove

Group (n)	N beg.(n)	X, mm	Spacing	N end (n+1)	X, mm
1	-15	-1480.0	450.0	30	18770.0
2	30	18770.0	335.0	70	32170.0

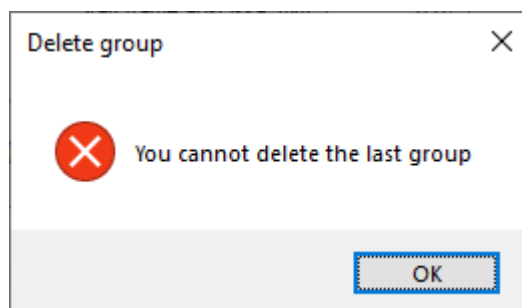
Drawing 12. Creating new group

After that it is necessary to enter **N beg.(n)**, **N end (n+1)**, **spacing, mm** for the new group and click button **Apply to list**. Tabular list will display a new line for the newly created group. Maximum possible quantity of groups in every spacing table is 24. After 24 new group cannot be added (message is on dr. 13).



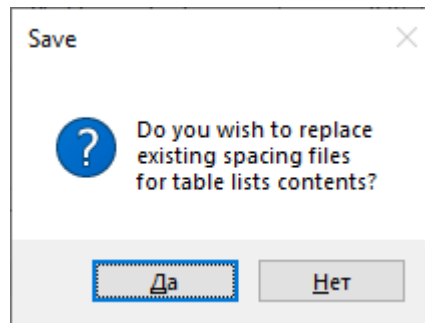
Drawing 13. Message on reaching maximum number of groups

Number of groups cannot be less than 1 (on attempt to delete the last group user will get message as on dr. 14).



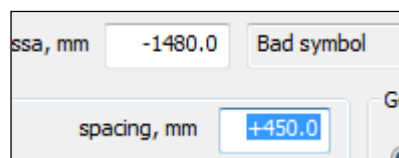
Drawing 14. Message on removing the last group

After changing data and sending them to the tabular user can save them to disk with button **Save** for all the four tables of the project. This will close dialog box **Spacing Tables**. Before saving there is a request (dr. 15).



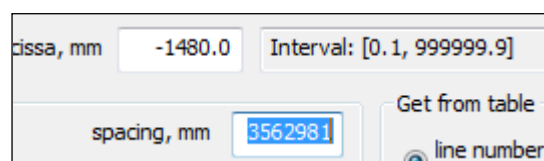
Drawing 15. Request on replacing data

Data input is controlled for correctness. Value of start line coordinate can be integer or real number, include not more than one decimal point, minus sign is permitted (comma and plus are forbidden). After the attempt on entering invalid symbol program sets focus to this field and produces error message in the right side of the tab (dr. 16).



Drawing 16. Message on bad symbol

Entering numbers of the boundary lines in the group is possible only with vertical counters. Values are automatically controlled. The least possible number is -999. The greatest number may be 9999, but in the last group. Spacing and line coordinate values are verified for some limits. The widest boundaries for spacing are 0.1 and 999999.9 mm. For start line coordinates permitted any values from -99999.9 to 999999.9. After leaving the limits a message is generated with possible boundaries, mm (dr. 17).



Drawing 17. Message about leaving possible limits for the value

2.4.4. Calculations by active spacing table

After selecting tab of required spacing table user can run calculations of two types for planes of frames, waterlines, buttocks. Type is selected from two radio buttons in the upper part of right area **Get from table** (dr. 18):

- **line numbers and additions;**
- **coordinates, mm.**

Drawing 18. Area **Get from table**

In the case of calculating number and addition of the line plane by its coordinate it is necessary to fill upper box (dr. 19) with integer coordinate value (it is named: **X** for frames and design sections, **Y** for buttocks, **Z** for waterlines) and press button **Run**. Result will be shown in the boxes **N** and **\$** (dr. 20). Addition (in **\$**) is always given non-negative and less than spacing value in the taken ship region. While entering coordinate user must consider the sign (e.g. buttock halfbreadths of the portside must be negative, and of the starboard side must be positive).

Drawing 19. Data input
for calculating line number and addition

Drawing 20. Result
of calculating line number and addition

In case of calculating line plane coordinate by line number and addition user must fill boxes **N** and **\$** with integer values (dr. 21) and press button **Run**. Result will be shown in the field **X** (dr. 22). Depending on type of line box **X** can be named **Y** or **Z**. In the box **\$** any values can be entered, negative and exceeding spacing values are possible.

Drawing 21. Data input for calculation of line plane coordinate

Drawing 22. Result of calculation for line plane coordinate

Possibility of input any values as additions helps with these two calculations to convert any line number and any addition to the form where addition will be non-negative and less than spacing in the taken ship area. First of all set radio button on **coordinates, mm**, then enter values of number and addition (for example, 27 and -750) and get the line coordinate (e.g. 16670). As a second step switch on **line numbers and additions** and by coordinate (16670) run calculation of line number and addition. Possible result: 25 and 150, if spacing in the example equals 450 mm and start frame abscissa is equal to -1480.0 mm (for frame -15).

2.5. Projects management

Scheme of projects management is based on special organization of folders and project files. At any time user can change project, create new project.

Items **General parameters** and **Spacing tables** in menu **MODEL** open corresponding dialog boxes where button for changing project is present, it enables project selection for editing general parameters or spacing tables.

3. GEOMETRIC MODEL

3.1. Structure of geometric model

Geometric model of N-Ship is mostly wireframe and contains objects representing hull forms, hull structures and other objects. It is a DWG file consisting of entities located in Model space on layers with specific names rule. Layer names must satisfy to N-Ship naming rule structure:

$\langle_ \rangle + \langle type \rangle + \langle number \rangle + \langle addition \rangle + \langle_ \rangle + \langle partition \rangle + \langle_ \rangle + \langle subpartition \rangle + \langle_ \rangle$.

Here:

$\langle_ \rangle$ — subscription symbol (" ");

$\langle type \rangle$ — type name, only latin letters (FR, WL, BT, UD, BH etc.);

$\langle number \rangle$ — number (integer -32768 to 32767) of the nearest main line (main line has addition=0);

<addition> — empty string for zero addition (e.g. it is name of main frame) or string like “\$”
 + <positive integer> (if it is name for intermediate frame moved forward);

<partition> and <subpartition> — integer numbers from -32768 to 32767.

For example:

_FR18_0_0_ — main frame 18, partition 0, subpartition 0;

_FR72\$150_1_16_ — intermediate frame, moved 150 mm forward from main frame 72, partition 1, subpartition 16;

_WL4_0_-2_ — waterline 4, partition 0, subpartition -2;

_UD0_3_1_ — upper deck (UD) line with No. 0, partition 3, subpartition 1.

Note. In various localizations name prefixes are being given in corresponding languages, e.g. English (FR, WL, BT, DS, UD, etc.), Russian (ШП, БЛ, БТ, ШТ, БП, etc.).

Layer naming must be done with consideration of spacing tables.

Geometric model in system N-Ship and in compatible systems has the following axes orientation relative to world coordinate system (WCS):

- ship abscissae axis is directed along world Z axis of nanoCAD;
- ship ordinates axis is directed along world X axis of nanoCAD;
- ship applicates axis is directed along world Y axis of nanoCAD.

Therefore we see Body plan in world axes X and Y. This is a base principle of model initialization and adaptation operations.

3.2. Ship coordinate systems

Ship entities are to be created with three main user coordinate systems (UCS): KOR (WCS) — for Body plan, BAT — for Elevation view and WL — for Waterline view. Local axes of UCS KOR are directed along world axes X and Y of nanoCAD, local axes of UCS BAT are directed along world axes X and Z of nanoCAD, local axes of UCS WL are going along world axes Y and Z of nanoCAD.

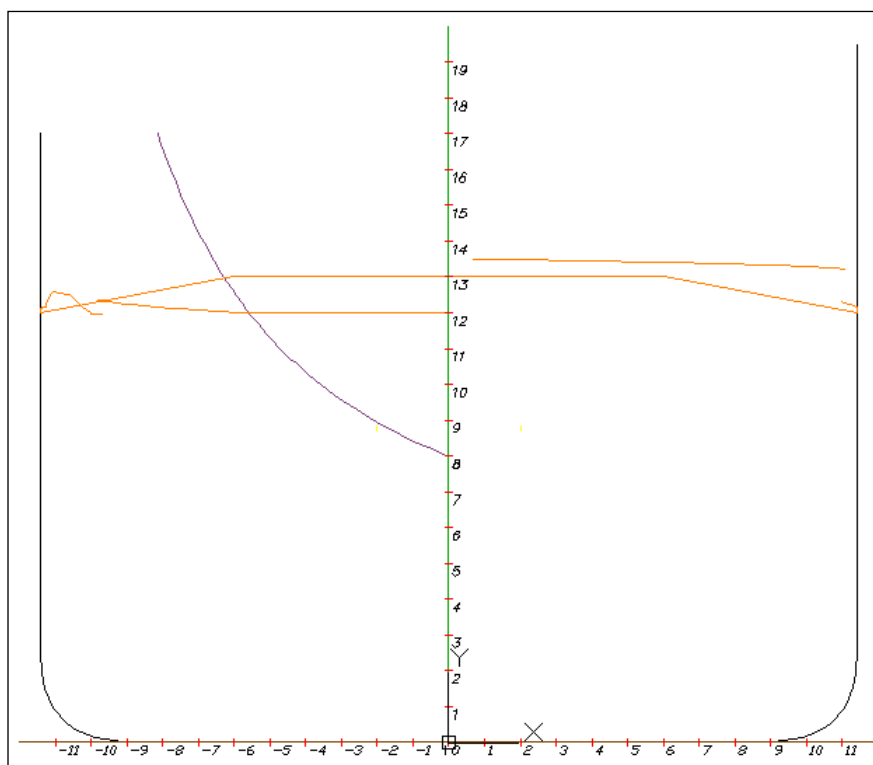
For special cases (e.g. when ship abscissae axis is directed from fore to aft, etc.) there are auxiliary UCSs: -KOR, -BOK, -PSH, -PSH-, PSH-. They differ from main UCSs by changed axes direction.

All the mentioned UCSs are created while model initialization (see par. 4.1).

3.3. Ship standard views

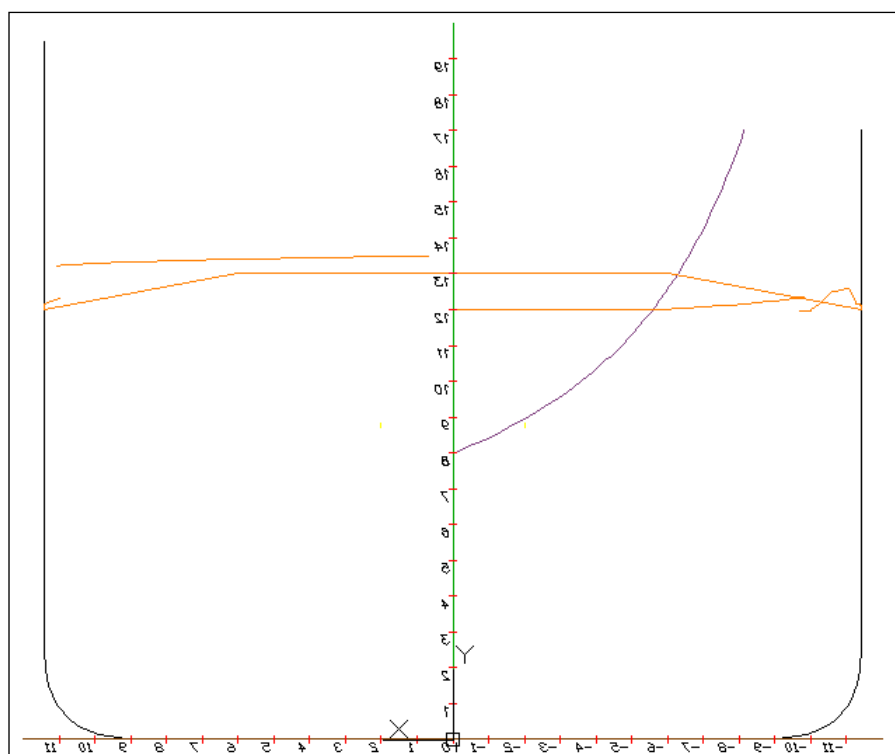
For more convenient work with model the initialization command creates four main views: KOR for body plan, BOK for elevation view, PSH for waterline view and TZ for isometric view. Besides main views there are also additional views: -KOR, -BOK, -PSH, -PSH- and PSH-, with different view direction.

In the KOR view there is used an automatic UCS KOR (dr. 23).



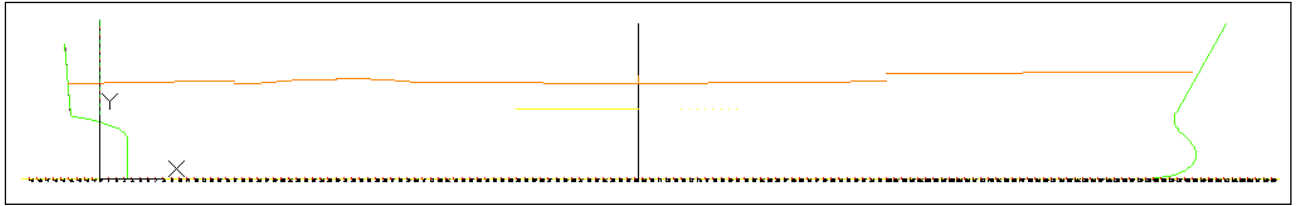
Drawing 23. View KOR with UCS KOR

Changing UCS from KOR to -KOR changes direction of the local axis X to an opposite one.
 -KOR is a reverse view to the view KOR (dr. 24).



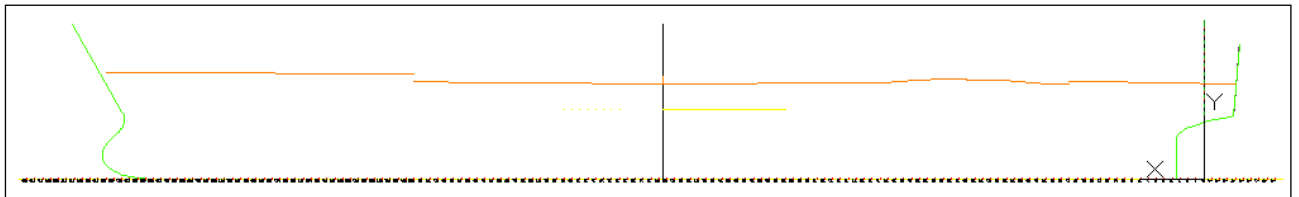
Drawing 24. View -KOR with UCS KOR

In the view BOK there is automatically set UCS BAT (dr. 25).



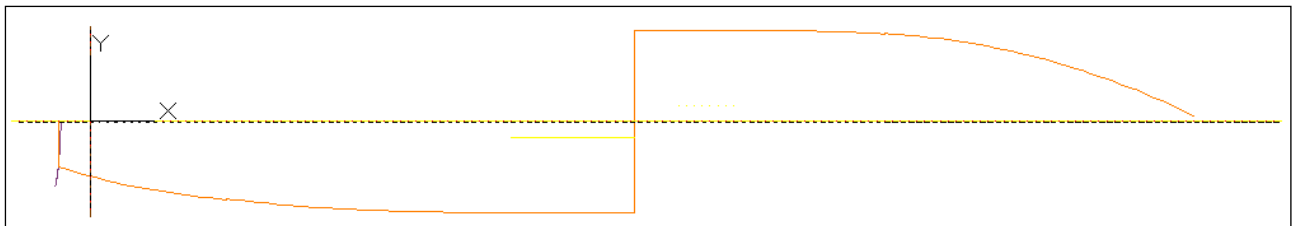
Drawing 25. View BOK with UCS BAT

Changing UCS from BAT to -BAT changes direction of the local axis X to an opposite one.
View -BOK is a reverse view to the view BOK (dr. 26).



Drawing 26. View -BOK with UCS BAT

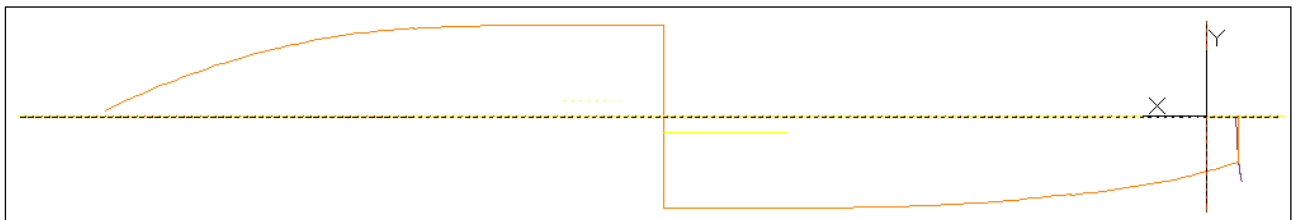
In the view PSH there is automatically set UCS WL



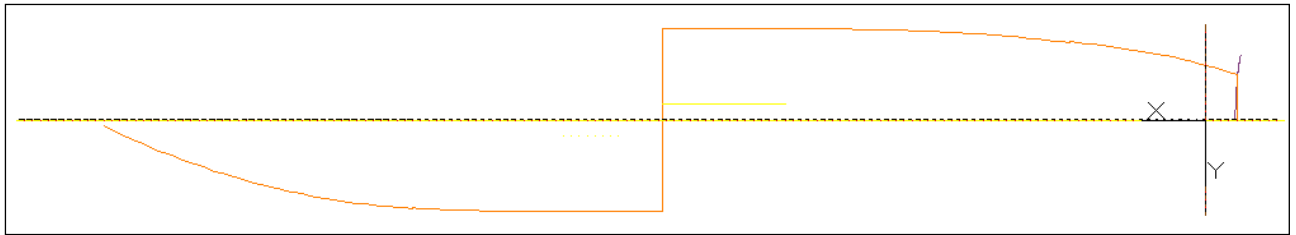
Drawing 27. View PSH with UCS WL

Changing UCS from WL to -WL changes direction of the local axis X to an opposite one.
Changing UCS from WL to -WL- changes directions of the local axes X, Y to an opposite one.
Changing UCS from WL to WL- changes direction of the local axis Y to an opposite one.

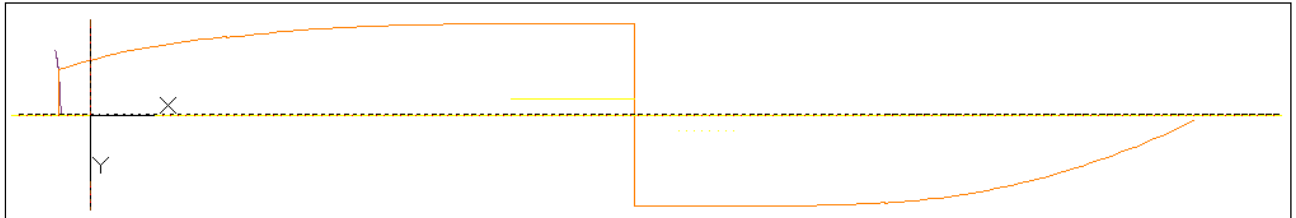
-PSH, -PSH- and PSH- are reverse or overturned views to the view PSH (dr. 28, 29 and 30).



Drawing 28. View -PSH with UCS WL

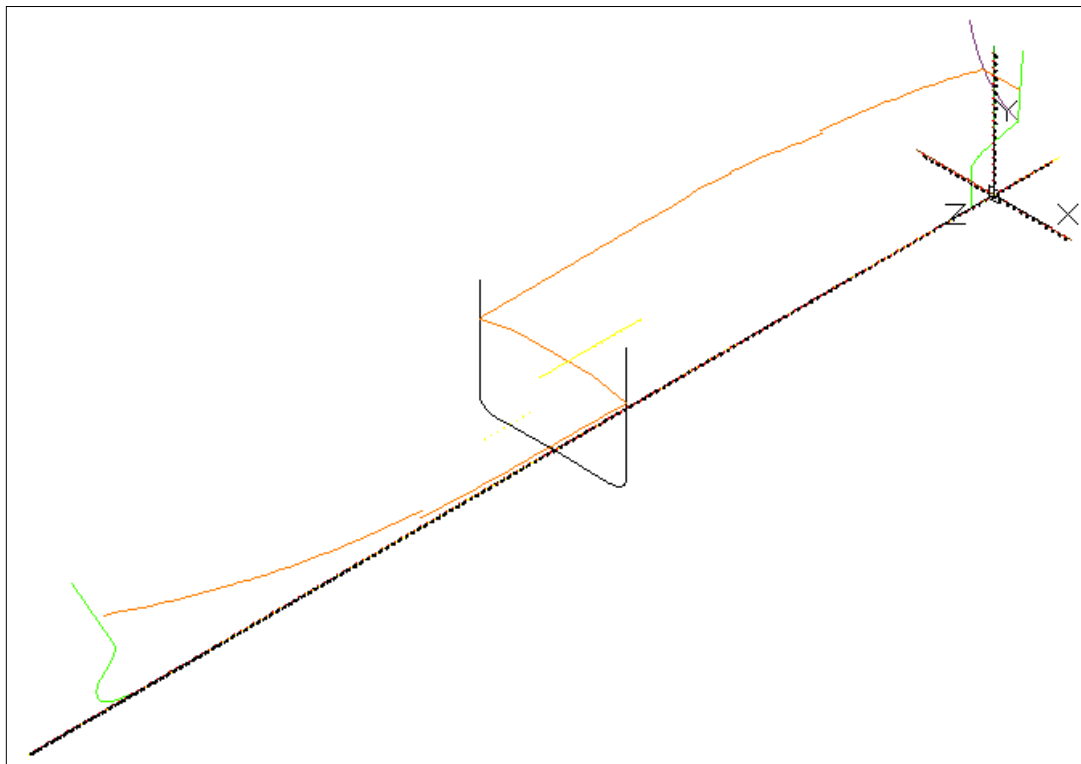


Drawing 29. View -PSH- with UCS WL



Drawing 30. View PSH- with UCS WL

Dr. 31 demonstrates isometric view TZ.



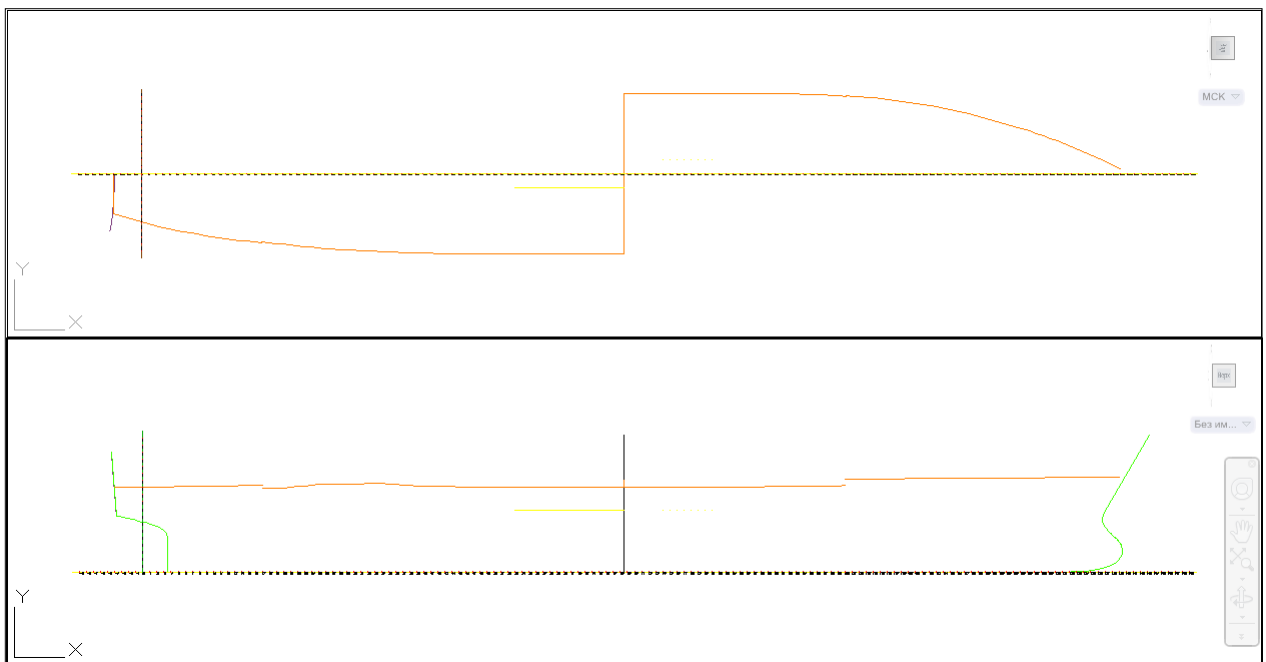
Drawing 31. Isometric view TZ with WCS

3.4. Ship standard viewport configurations

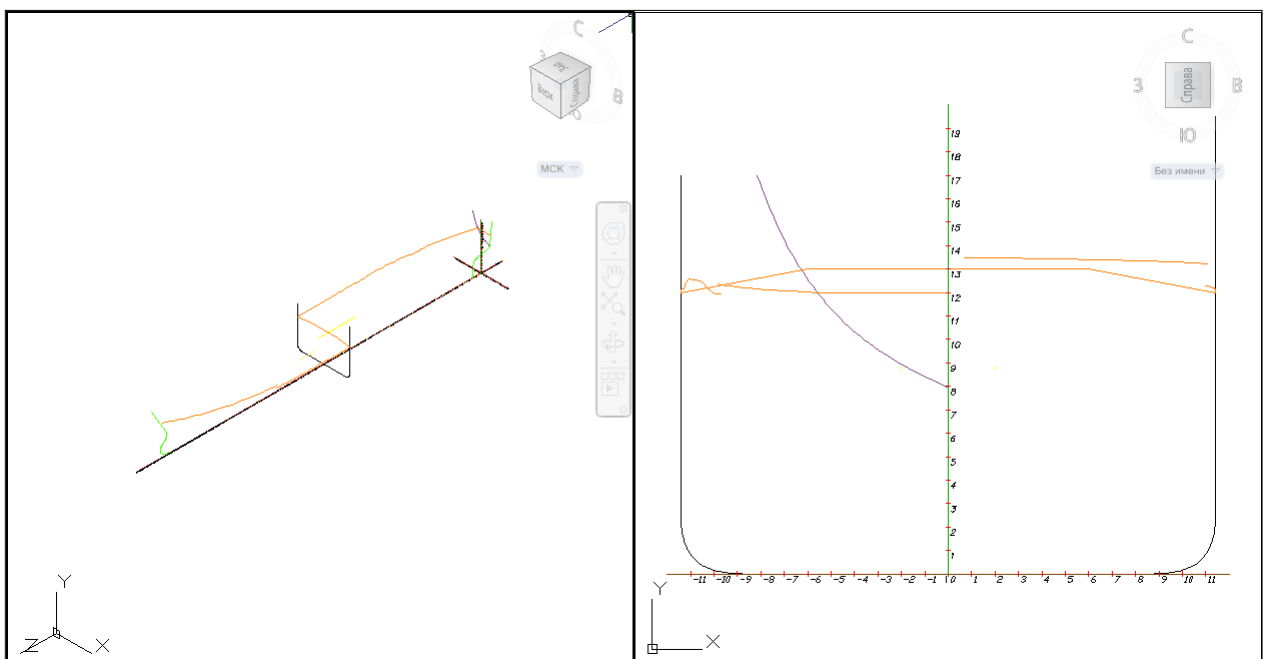
For more comfortable work there are viewport Model configurations of one-, two-, three- and four parts viewports (VP). The following names are used for VP:

- KOR for one screen configuration with view KOR;
- BOK for one screen configuration with view BOK;
- PSH for one screen configuration with view PSH;
- TZ for one screen configuration with isometric view TZ;

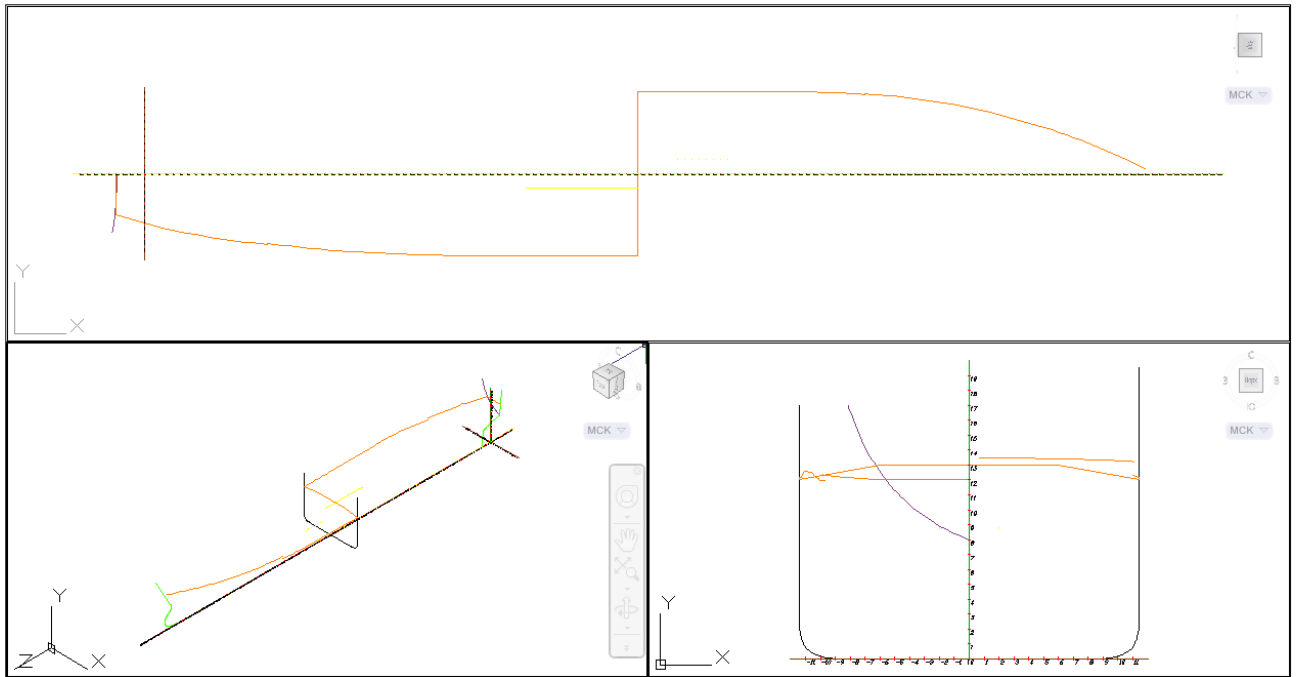
- PB for two screens configuration (top view PSH, bottom view BOK, dr. 32);
- TK two screens configuration (left view TZ, right view KOR, dr. 33);
- TPK for three screens configuration (top view PSH, bottom left view TZ, bottom right view KOR, dr. 34);
- TBK for three screens configuration (top view BOK, bottom left view TZ, bottom right view KOR, dr. 35);
- TPBK for four screens configuration (most top view BOK, top lower view PSH, bottom left view TZ, bottom right KOR, dr. 36).



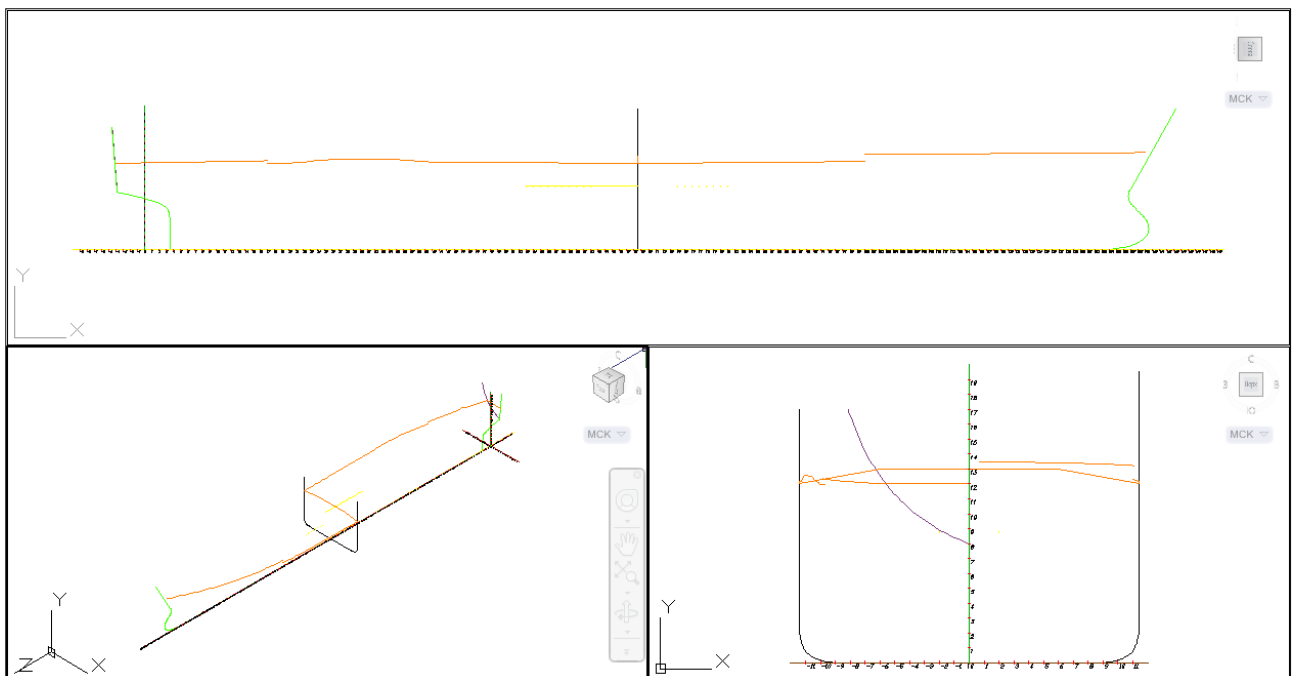
Drawing 32. Viewport PB



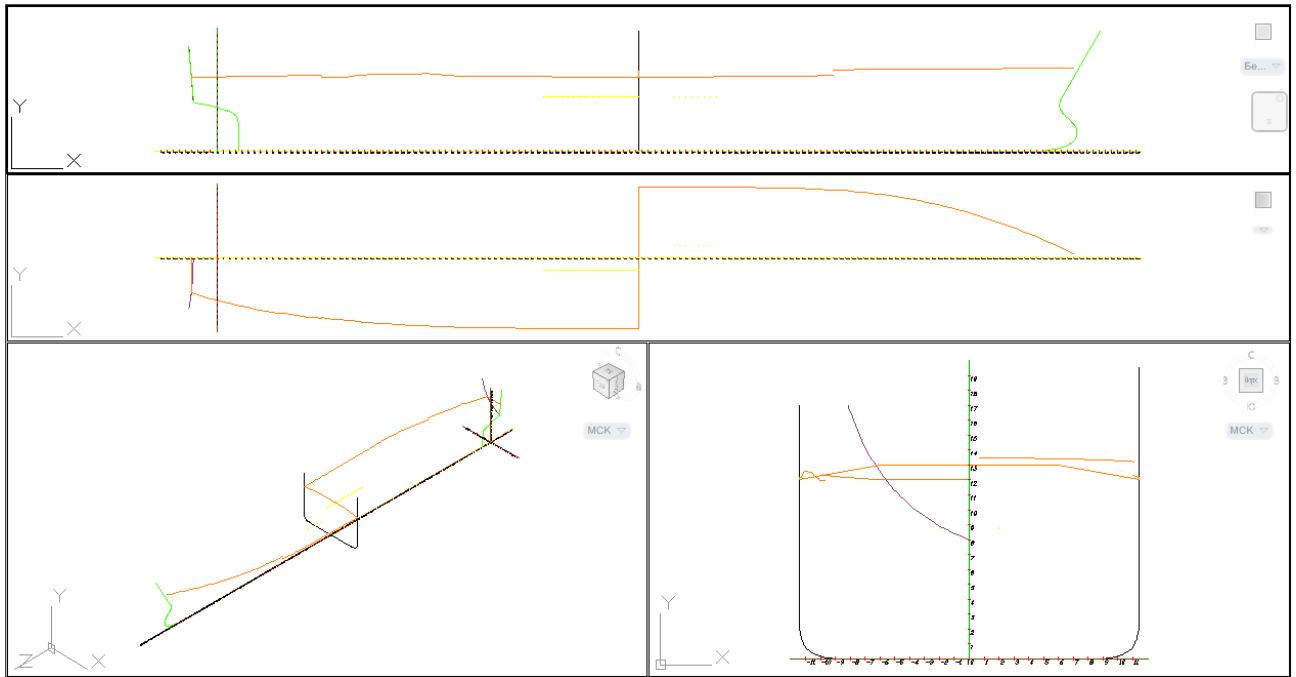
Drawing 33. Viewport TK



Drawing 34. Viewport TPK



Drawing 35. Viewport TBK

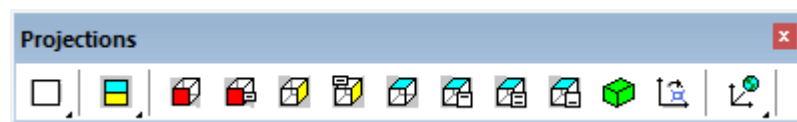


Drawing 36. Viewport TPBK












Note. Possibility of creating VP configuration TPBK is not realized in current version
Creation of named model viewports is done during model initialization (see par. 4.1).

























3.5. Toolbar Projections

Toolbar **Projections** (dr. 37) serves for setting views, VP configurations, ship UCSs.

Drawing 37. Toolbar **Projections**

The following buttons are in the toolbar **Projections** (submenus are considered too):

-  — to set one screen VP configuration with current view;
-  — to set one screen VP configuration with view KOR;
-  — to set one screen VP configuration with view -KOR;
-  — to set one screen VP configuration with view BOK;
-  — to set one screen VP configuration with view -BOK;
-  — to set one screen VP configuration with view PSH;
-  — to set one screen VP configuration with view -PSH;
-  — to set one screen VP configuration with view -PSH-;
-  — to set one screen VP configuration with view PSH-;
-  — to set one screen VP configuration with view TZ;
-  — to set two screens VP configuration PB;

-  — to set two screens VP configuration TK;
-  — to set three screens VP configuration TPK;
-  — to set three screens VP configuration TBK;
-  — to set four screens VP configuration TPBK;
-  — to call command for 3D-orbit rotation with preliminary request for rotation center;
-  — to set view KOR in the active VP of model or layout;
-  — to set view -KOR in the active VP of model or layout;
-  — to set view BOK in the active VP of model or layout;
-  — to set view -BOK in the active VP of model or layout;
-  — to set view PSH in the active VP of model or layout;
-  — to set view -PSH in the active VP of model or layout;
-  — to set view -PSH- in the active VP of model or layout;
-  — to set view PSH- in the active VP of model or layout;
-  — to set isometric view TZ in the active VP of model or layout;
-  — to set view in plan of the current UCS;
-  — to set world coordinate system (WCS);
-  — to set UCS KOR;
-  — to set UCS -KOR;
-  — to set UCS BAT;
-  — to set UCS -BAT;
-  — to set UCS WL;
-  — to set UCS -WL;
-  — to set UCS -WL-;
-  — to set UCS WL-.

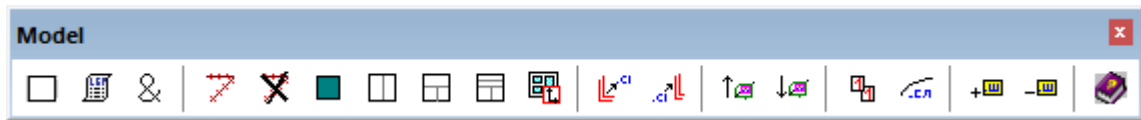
UCS designation is discussed in par. 3.2.






















4. TUNING MODEL

Geometrical model requires certain operations for tuning.

4.1. Model initialization

Buttons for work with geometric model using N-Ship structure are included in the toolbar **Model** (dr. 38):

Drawing 38. Toolbar **Model**

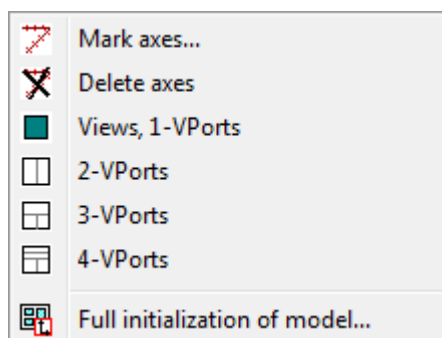
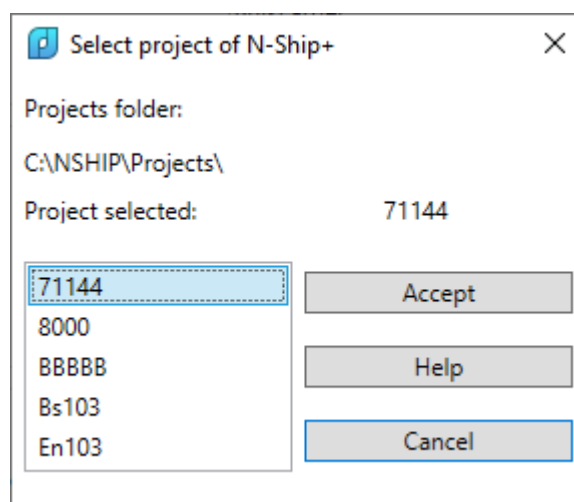
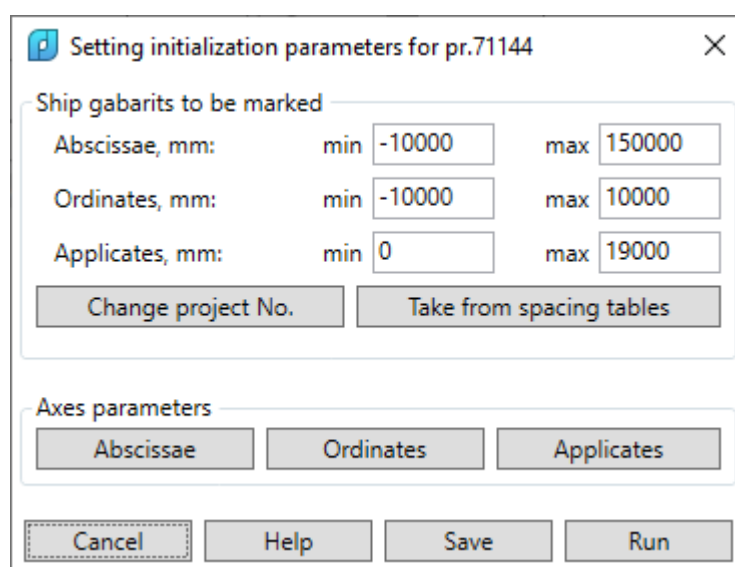
-  — creating new project;
-  — editing general parameters file;
-  — editing spacing tables;
-  — building main model axes;
-  — deleting axes;
-  — creating one screen VPs;
-  — creating two screens VPs;
-  — creating three screens VPs;
-  — creating four screens VPs;
-  — full model file initialization (with axes, views, VPs);
-  — adaptation of model to elevations;
-  — adaptation of model to layers;
-  — hiding objects;
-  — restoring visibility of hidden objects;
-  — setting current partition and subpartition values for naming lines;
-  — naming ship lines;
-  — adding hypernames;
-  — removing hypernames;
-  — hiding hypernames;
-  — restoring hypernames display;
-  — calling module **Model** help system.

Model initialization is a group of operations over DWG file, creating and marking boundaries of main ship model zone for current project (views, viewports, UCSs) and building axes lines with specific marks (frame numbers, etc.). Initialization commands can be run with submenu items **MODEL > INITIALIZATION** (dr. 39) or with buttons of the toolbar **Model**.

Full initialization is executed with button  or with menu item **Full initialization of model**. After start command opens dialog box **Select project** (dr. 40).

If click button **Cancel** then command will not be run.

After selection of project name and click **Accept** next window **Setting initialization parameters for pr.NNNNN** opens (dr. 41).

Drawing 39. Submenu **INITIALIZATION**Drawing 40. Dialog box **Select project**Drawing 41. Dialog box **Setting initialization parameters**

Area **Ship gabarits to be marked** of the window contains edit boxes for minimum and maximum values for abscissa (axis Z of nanoCAD), ordinate (axis X of nanoCAD) and applicate (axis Y of nanoCAD) for the ship working zone to be marked. Initial values of the fields are read from file *np_model.ini* in the project folder.

Button **Change project No.** allows to select other project to use its data as current (selection is made from existing projects). Button **Take from spacing tables** reads minimal and maximal values from spacing files (with extensions .&sp, .&bp and .&wp) and fills with them edit boxes of area **Ship gabarits to be marked**.

Axes parameters is a group of three buttons to call dialogs for setting parameters of building axes lines, mark dashes and text for axes numbering (see par. 4.2 about axes settings).

In the lower part of the window there are the following buttons:

- a) **Run**, closes dialog and starts initialization; if parameters were changed then a request for saving is issued;
- b) **Save**, saves parameters to *np_model.ini* in the project folder;
- c) **Cancel**, closes window and cancels initialization;
- d) **Help**, calls help topic.

Input values are saved to the settings file *np_model.ini* of the project folder. If the file does not exist (e.g. first time initialization) then it will be created with default values.

4.2. Parameters of form and axes contents for model

Group **Axes parameters** of dialog box **Setting initialization parameters for pr.NNNNN** (cm. dr. 42) comprises three buttons (**Abscissae**, **Ordinates** and **Applicates**). According to their captions these buttons allows to tune form and contents of 3 geometric model axes. Let us discuss these settings on example of abscissae axis.

Click on button **Abscissae** opens dialog window **Parameters of ship axis: abscissae (axis Z nanoCAD)** (dr. 42). Corresponding windows for other axes are named **Parameters of ship axis: ordinates (axis X nanoCAD)** and **Parameters of ship axis: applicates (axis Y nanoCAD)**.

Drawing 42. Dialog box **Parameters of ship axis: abscissae (axis Z nanoCAD)**

Parameters filling is governed first of all by checkboxes **Axis line**, **Marking dashes** and **Marking text**. These parameters work independently from each other (e.g. it is possible not to draw axis line but to draw dashes and marking text).

If user checks box **Axis line** then there will be drawn a long segment for axis line. Its color is set by parameter **Line color**, its layer is defined by parameter **Line layer**. To select color user must click on color rectangle to the right from **Line color** and in the standard nanoCAD dialog box **Select Color** pick required color number. By default lines are to be located on the layer **_AXIS**.

If to check box **Marking dashes** then segments of dashes will be created across axis line. Dashes are positioned: for abscissae axis on abscissae of frames with integer numbers, for ordinates axis on buttocks halfbreadths with integer numbers, for applicates axis on waterlines heights with integer numbers (all only inside marked zone). Dash overhang (out of axis) value is defined by parameters **up, mm** and **down, mm**. Parameter **Dashes color** sets color with which dash segments will be drawn.

Setting dash layer names are ruled by radio buttons group **Dashes layer**. If radio button **from axis** is activated then dashes will be on the same layer as axis line. If radio button **individual** is set then dashes will be located on layers of corresponding frames but with partition -1 and subpartition -1 (e.g. **_FR18_-1_-1_**).

If to check box **Marking text** then text parameters will become enabled. This text is drawn near dashes. Group of radio buttons **Form** defines text form:

- **number**, line numbers (frames, buttocks or waterlines);
- **mm**, millimeters;
- **m**, meters.

For two last types there must be entered **No. of digits after point**, that will define number of digits after decimal point in the mark text (default 0). Group of radio buttons **Step** allows to numerate not all the marking elements (frames, waterlines, buttocks), but only those which numbers are divisible by the values: 2, 5, 10, 20 (selection of 1 means numbering all lines).

Parameter **Height, mm** defines text symbols height (default 150). Moreover, parameters **Color** and **Layer** declare values of these text properties. **Dist by X** and **Dist by Y** are distances for text movement for better reading (by zero values left lower corner of the text will coincide with intersection point of axis line and dash line), usual values are 100 and -250. Group **Text orientation with ref to axis** includes radio buttons **along** and **normally**, they correspond to identical types of text location relative axis.

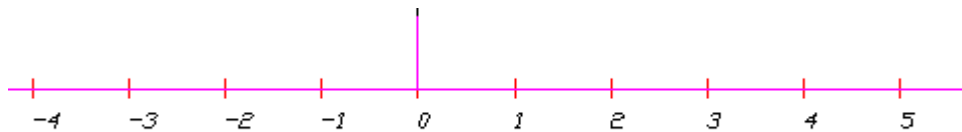
By setting checkbox **Annotative** marking text is created as annotative (height and moves in the dialog box correspond to annotation scale 1:1).

Note. After repeated initialization old axes and mark elements **are not removed**! Therefore either drawing of elements must be disabled or replaced elements must be selected by layer (for

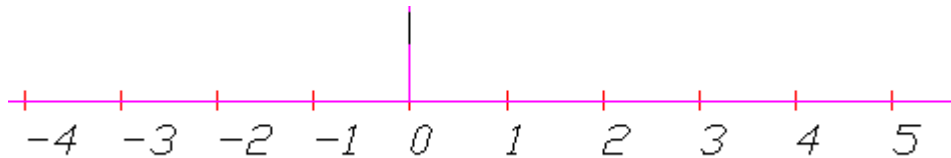
example with command QSELECT) and removed before reinitialization (by command **Delete axes**).

4.3. Annotation scale support

Axis mark text can be *annotative* (this property application is ruled by checkbox **Annotative**). Annotativity enables text height change with annotation scale change. On dr. 43 and 44 there is a sample decoration of model abssisae axis with annotative text for annotation scale values 1:1 and 1:2. In the second case text height is two times greater. As a scaling base left upper point of text is used.



Drawing 43. Text view with annotation scale 1:1



Drawing 44. Text view with annotation scale 1:2

Note. Annotative feature is still not implemented.


4.4. Changing project

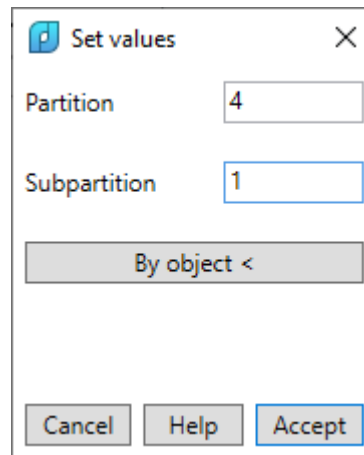
Just after calling the dialog box **Setting initialization parameters for pr.NNNNN** current project name is taken current project from the overall settings of N-Ship system (it is directly connected to the current project_port name).

If it is necessary to take different project then user must click button **Change project No.** in the dialog box **Setting initialization parameters for pr.** This will open window **Select project**.

4.5. Partition and subpartition

While preparation of geometric model for later process in the system all the model lines must be located on special layers. Partition and subpartition are used in layer names to differ objects lying in the same plane (more often in the frame plane), but referred to different structures. For example, partition 0 and subpartition 0 are usually connected to theoretical surface section lines of hull forms, and partition 1 and subpartition 0 are used for upper deck lines.


Menu item **MODEL > Current partition and subpartition** as well as button  of the toolbar **Model** call dialog box **Set values** (dr. 45), targeted for setting new current values of partition and subpartition used in operations of naming model lines. Partition and subpartition parameters may accept only integer values from -32768 to 32767.



Drawing 45. Dialog box **Set values**

It is possible to set current values with reading them from existing model object, user must click on button **By object**. This temporarily closes dialog box and requests model object selection. If selection is valid then new current partition and subpartition values will be set to those read from the object.

4.6. Line naming

The command moves selected entities to layers defined by user. This operation enables individual names of all the objects of the ship model. Layers are automatically created in N-Ship threedimensional model structure. Command can be run with menu item **MODEL > Line names**, and with button  of toolbar **Model**.

At the very beginning command opens dialog box **Select project**, where user must select project name (from the list of existing projects). After selection and clicking button **Accept** the main command window **Naming model lines, pr.NNNNN** (dr. 46) opens, where NNNNN is selected project name (number).

The window is intended to form line name from the necessary parts. The resulting name will be then used to move object(s) to this layer. If the layer does not exist it will be automatically created.

Model layer name consists of the following parts:

- type (FR, WL, BT, UD, BH, etc., only English and Russian letters are admitted and converted into upper case); entered in the field **Type**;
- base line number (integer, can be negative); entered in the field **Number**;
- addition, or move from base line (non-negative, can be zero); entered in the field **Addition**;
- partition (integer between -32768 and 32767, plus sign is not allowed); entered in the field **Partition**;
- subpartition (integer between -32768 and 32767, plus sign is not allowed); entered in the field **Subpartition**.

Drawing 46. Dialog box **Naming model lines, pr.**

During input process all the name parts are checked for validity, and in case of finding invalid symbols an error message is generated. Front and back spaces are automatically deleted. In the field **Type** all the spaces are removed, even if they are inside the type. In the other fields middle spaces cause error message.

User can take types from predefined lists 1, 2 and from the list 3 that is filled by user himself. Clicking on any element in these lists sends element name to the field **Type**.

List 1 includes the following standard values: AXIS, BLWK, BOTTOM, BT, DCK, DS, FCD, FLD, FR, MB, PLT, POD, SHFTL, SHRS, TRANSOM, UD, WL. List 2 contains these values: ABUTT, ALG, ASEAM, BEAM, BH, BST, BUTT, CRL, DFRG, GD, KEEL, LG, MTB, SLG, SM, SST, STF, STSL, TKEEL, VKEEL.

List 3 is intended for saving type names from the user. On closing dialog with button **Accept** values from the list 3 are stored in the file np_setnami.ini, located in the selected project folder. User may add names to the list and remove names from it.

To add a name to list 3 one must enter name text in the empty field under list 3 and click button **Add to list 3**. After adding name the new list is displayed in the dialog box and is sorted.

To delete element from the list 3 it is necessary to select it and to click button **Remove from list 3**.

Parameter **LAYER NAME TO BE FORMED** demonstrates in real time what resulting name will be generated. On end of forming layer name user must press button **Accept**, after that window **Naming model lines, pr.** closes and program requests: **Select objects for moving to layer XXXXXXXX**, where XXXXXXXX is a layer name. User must by any possible method select objects to

be moved to the layer with formed name. After selection objects will change layer. If user fails to select objects (i.e. number of selected entities equals zero), then system will suggest: **Reselect or press Esc to refuse**. At this moment key Esc stops command of renaming lines.

On operation complete a message appears: ***n object(s) moved to layer XXXXXX***. Then dialog box **Naming model lines, pr.** reopens and user can continue the operation of naming lines.

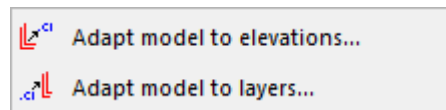
In the current graphical editor session last values of type, number and addition are offered to user as initial in the next call of dialog box **Naming model lines, pr.**. If the call is first then window displays default values:

- in the field **Type**: SL;
- in the field **Number**: 0;
- in the field **Addition**: 0;
- in the field **Partition**: current model partition value;
- in the field **Subpartition**: current model subpartition value.

On current values of partition and subpartition see par. 4.5.

5. MODEL ADAPTATION


Submenu **ADAPTATION** (dr. 47) includes two commands for model adaptation.



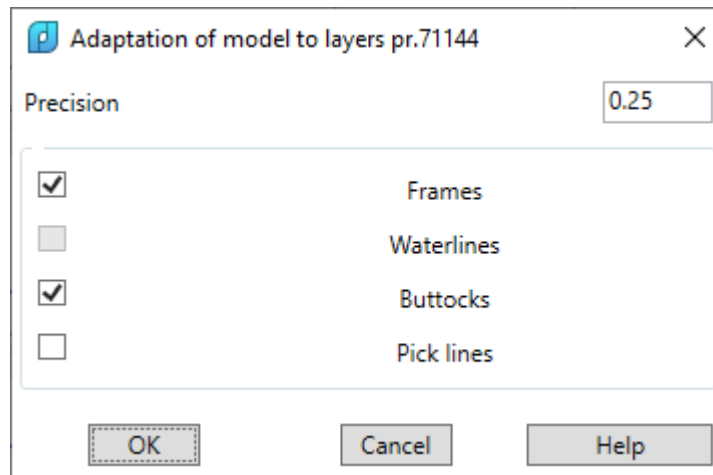
Drawing 47. Submenu **ADAPTATION**

5.1. Adaptation of model to layers

If model lines already have layer names corresponding to structure of N-Ship geometric model, then it is possible to make automatic adaptation of model to layers. This means that flat lines that are fully located in the planes parallel to the main ship planes, and have layer names of frames, waterlines and buttocks (these names begin with prefixes **_FR**, **_WL** and **_BT**, e.g.: **_FR15\$150_0_0_**, **_WL1_5_2_**, **_BT0_2_0_**), will be moved to new elevations that are calculated by layer names (i. e. by numbers of frames, waterlines, buttocks). Adaptation operation is applied only to entities that are 2D polylines, flat 3D polylines, arcs or flat splines. Moreover their layer names must be correct (frame lines must lie in the plane parallel to middle frame plane, waterline lines must lie in the plane parallel to base plane, buttock line must be parallel to the center line plane).

Menu command **MODEL > ADAPTATION > Adapt model to layers** and button  of toolbar **Model** first call dialog box **Select project**. In the dialog user must select project name (number), for which model adaptation will be done.

Next dialog box **Adaptation of model to layers** (dr. 48) is opened.




Drawing 48. Dialog box **Adaptation of model to layers**

In this window it is necessary to check boxes defining types of lines to be involved into adaptation (**Frames**, **Waterlines**, **Buttocks**). Program is analyzing model, and if it finds out that there are no objects (polylines, arcs, splines) of some of these three types then corresponding checkboxes will be disabled (**Waterlines** on dr.). There are two more elements in the dialog box **Adaptation of model to layers pr.:**

- **Precision**, this is a precision (mm, non-negative number) with which polyline points are verified for lying in one of three main planes (0.25 mm by default);
- **Pick lines**, if this box is unchecked then all the model lines will be scanned; if it is set then user will be asked to pick objects to be included into adaptation.

At the end there is generated a message about quantity of edited polylines, splines, arcs and following model refreshment.

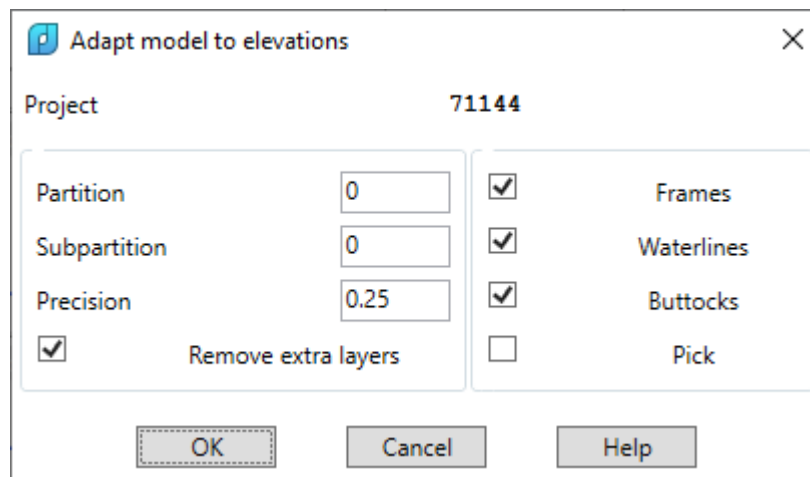
5.2. Adaptation of model to elevations

This operation is targeted to move 2D-polylines and flat 3D-polylines lying in planes parallel to base planes (middle frame plane, zero height plane, central line plane) to layers by their elevations. Names of layers for frames, waterlines and buttocks are created automatically from current project spacing tables. The operation is run with menu item **MODEL > ADAPTATION > Adapt model to elevations** or with button  of toolbar **Model**.

At the beginning dialog box **Select project** is opened. It is necessary to select project, from which spacings will be used for layer names.

Next is dialog box **Adapt model to elevations** (dr. 49), where three parameters must be set:

- partition number for names of created layers (default 0);
- subpartition number for names of created layers (default 0);
- precision with which polyline points are verified for belonging to plane parallel to one of base planes (default 0.25 mm).



Drawing 49. Dialog box **Adapt model to elevations**

These data are entered in the fields **Partition**, **Subpartition** and **Precision**.

Categories of lines lying in planes parallel to base planes, are set by checkboxes **Frames**, **Waterlines** and **Buttocks**. By default all the checkboxes are set on. If at start program does not find spacing table of some type then it disables corresponding checkbox in the window.

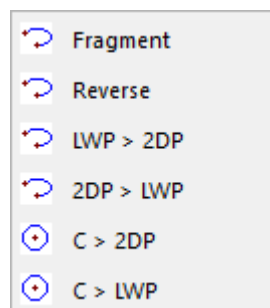
If box **Pick** is unchecked, then all the model lines are scanned. If the box is checked then user will be asked to pick objects that will take part in adaptation operation.

Found frames, waterlines and buttocks from selected (only 2D- and 3D-polylines) are moved to the layers with names created according current project spacing tables. Current partition and subpartition values are applied to layer names. At the end there is a message about number of translated polylines.

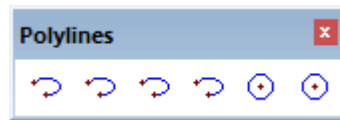
Checkbox **Remove extra layers** allows after adaptation to purge all the unused layers of the current DWG drawing.

5.3. Submenu **POLYLINES**

Submenu **POLYLINES** (dr. 50) and toolbar **Polylines** (dr. 51) contain commands for smart operations with 2D-polylines.



Drawing 50. Submenu **POLYLINES**

Drawing 51. Toolbar **Polylines**

Command **Fragment** requests two points limiting a fragment of an existing closed or open polyline (2D-POLYLINE, LWPOLYLINE) and creates new LWPOLYLINE (fragment copy) lying over the parent entity, on the same layer and in red color (if source line was red then new color is blue). Interpolation preserves existing widths of the segments involved. Command's dialog:

Creating polyline fragment.

1st point of fragment:

2nd point of fragment:

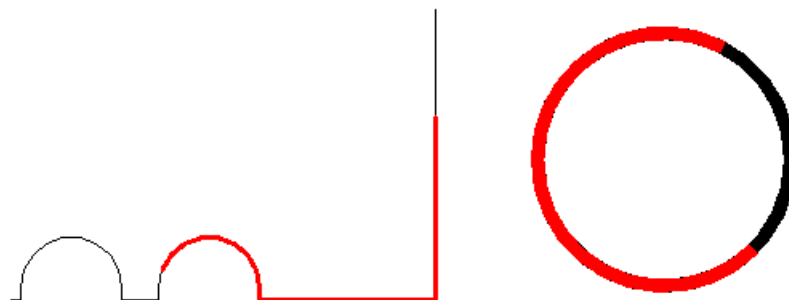
Point inside selected fragment:

<Entity name: 21c1f030>

Request for a point inside a fragment provides opportunity to define the right part of the closed line.

Note. Resulting object has type LWPOLYLINE.

On dr. 52 there are two samples of building fragment (it gets red color).



Drawing 52. Building polyline fragment

Both source objects are drawn in black. The right one has a nonzero global width. Intermediate points inside fragments were picked so that fragments must be built in required zone (and for a closed contour there are always two such zones). Program explores polyline and correctly manages the situation when the start polyline point is inside the fragment to be selected.

Command **Reverse** is intended for changing vertices sequence from direct to reverse, but without changing visible geometry. It can be applied for entities of type 2D-POLYLINE, LWPOLYLINE.

Commands **LWP > 2DP** and **2DP > LWP** convert LWPOLYLINE to 2D-POLYLINE and vice versa.

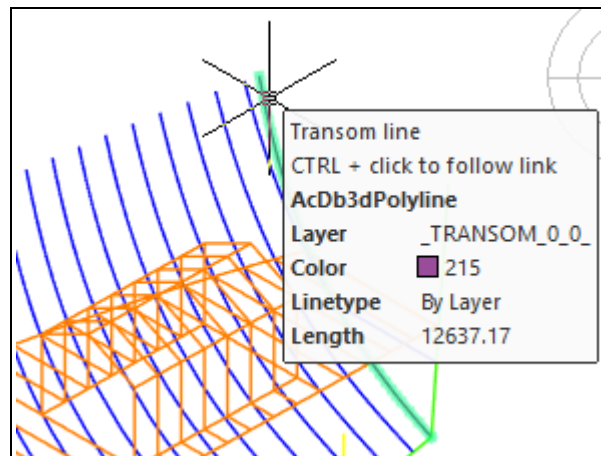
Commands **C > 2DP** and **C > LWP** convert closed circle (entity of type CIRCLE) to 2D-POLYLINE and to LWPOLYLINE, preserving geometry form.

6. HYPERNAMES

Model objects can have interactive prompts.

6.1. On hypernames

Hypername is a text generated by the user as a commentary to an entity. Any object as model element can have hypername (or not to have). While hovering the cursor over the entity with a hypername a rectangular box shows commentary text (dr. 53). It is a hyperlink but without a file linked to the object. Maximum recommended length of hypername is 56 symbols. Hypername can use any text symbols (latin and cyrillic letters, digits, dots, commas, subscription signs, etc.).

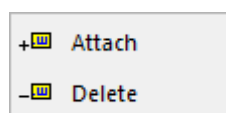


Drawing 53. Hypername

It is recommended to use layer name as hypername text. But cases of any other commentary are permitted for hypername too.


Hypername is a kind of hyperlink (but unlike usual hyperlinks has no link to file).

Submenu **HYPERNAMES** is a part of menu **MODEL** (dr. 54).

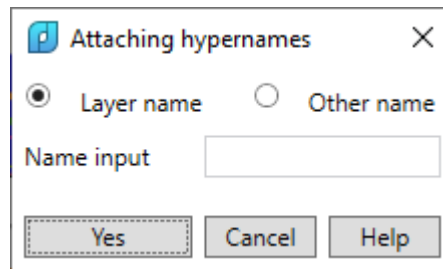


Drawing 54. Submenu **HYPERNAMES**

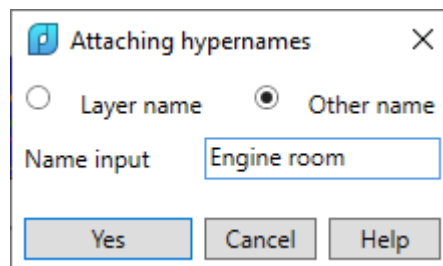
6.2. Attach hypernames

If you want to attach (or replace earlier attached) hypername to graphical object use menu item **MODEL > HYPERNAMES > Attach** or click button  of toolbar **Model**. Next program will request objects (*Select objects:*). User must pick objects for hypernames attachment.

After selection dialog box **Attaching hypernames** opens (dr. 55).

Drawing 55. Dialog box **Attaching hypernames**


In the upper zone of the window there are two radio buttons: **Layer name** and **Other name**. In the first case (recommended) each object will have hypername identic to its layer name (if model objects are located on different layers they will get different hypernames). In the second case in the dialog **Attaching hypernames** it is necessary in the field **Name input** (it will be enabled) to enter text to be taken as hyperlink text for all the selected objects. On the dr. 56 there is an example of name displayed.



Drawing 56. Input of other hypername text

Maximum hypername length is 56 symbols (longer names are allowed but will be cut in the middle part while displaying).

6.3. Remove hypernames



To remove earlier attached hypernames run submenu item **HYPERNAMES > Delete** or button  of toolbar **Model**.

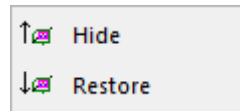
Command requests objects. User must pick objects from where hypernames will be removed.

7. MANAGEMENT OF INDIVIDUAL VISIBILITY

In complex models there is often necessity of temporarily hiding those objects that do not admit proper access to the most important model entities.

7.1. On individual visibility of objects

Model object can become invisible (e.g. for some time) even it is located on the layer that is thawed and on. This can be done with menu item **MODEL > HIDE > Hide** (dr. 57) or with button  of toolbar **Model**. Visibility of hidden entity can be restored with menu item **MODEL > HIDE > Restore** or with toolbar button .

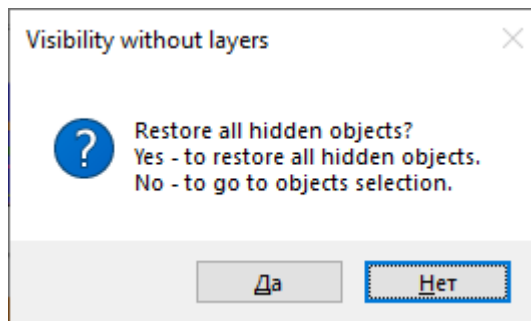
Drawing 57. Submenu **HIDE**

7.2. Hiding objects

After hiding objects they become invisible in all the layouts, in model space and in paper space. Therefore if you need to hide object only in one of the paper space viewports then use freezing layer relative to the viewport, it is a layer property.

7.3. Restoring visibility

After running **MODEL > HIDE > Restore** program requests (dr. 58):



Drawing 58. Request to unhide objects

At this moment all earlier hidden objects (if they are in thawed and switched on layers) temporarily become visible and are highlighted.

In case of **Yes (Да)** all the hidden objects are restored. In case of **No (Нет)** there is a new request:

Select objects to unhide <Exit>:

Select objects:

Now pressing key Enter stops restoration without action. If user selects objects with any method (click, window, other) and presses Enter, then only selected entities will become visible. Selection of extra unhidden objects does not affect this operation.

If object was not only hidden but also its layer was frozen then before un hiding the layer must be thawed. Otherwise they will not be accessible for selection.

8. RECOMMENDATIONS ON IMPORT OF MODEL

This paragraph contain some recommendations for model tuning process after import from the other ship CAD systems.

8.1. Model creation steps

Most often case of import is getting wireframe DXF/DWG file from other CAD program (e.g. 28123.dxf or 28123.dwg). The file must contain all the main frame lines at Body plan projection and

in full size in millimeters (not to be scaled). It may contain other ship lines (boundaries, sections). Frame lines must be 2D polylines or flat 3D polylines. The most popular is DXF file with frame lines lying on elevation 0.

If wireframe model must be built for two sides (starboard, portside) then frame sections must be separate lines for each sides (one side needs one entity).

If a 3D file is imported from the other CAD system then all the demands must be applied to waterlines, buttocks and boundary lines of flat ship structures. Lines bounding non-flat structures must be 3D polylines.

As a first step of model building/tuning in the N-Ship structure user must create four spacing table files (e.g. for project 28123):

- frames (28123.&sp),
- design sections (28123.&st),
- buttocks (28123.&bp),
- waterlines (28123.&wp).

These files are automatically located in the folder design data of the project with this name, inside *Projects* folder. Path to the last mentioned folder is saved in Windows registry (HKEY_LOCAL_MACHINE\SOFTWARE\ NSHIP\N-Ship+\projects\nano), it was written while installing N-Ship+. Most often this path looks like *D:\NSHIP\Projects\28123*. For details see par. 8.2.

Second step is to insert DXF file (e.g. 28123.dxf) or DWG file (e.g. 28123.dwg) into the current drawing in such a way that inserted lines do not create a block definition and ship X axis is directed along Z axis of nanoCAD WCS.

Third step is model initialization using menu **MODEL** (submenu **INITIALIZATION**).

If a two dimensional file is being imported then there is a fourth step for renaming layers of frame lines (for example _FR28_0_0_, _FR52\$150_0_0_, etc.) and other model lines. Next as a fifth step it is required to make conversion of two dimensional model into three dimensional (**ADAPTATION > Adapt model to layers**).

If imported file was received in a three dimensional form (frame lines are located on their elevations), then the fourth step is automatic naming of frame lines according to their elevations, with **ADAPTATION > Adapt model to elevations**. The same is for waterlines and for buttocks.

More details in par. 8.3.

8.2. Spacing tables

Before creation of spacing tables it is necessary to create design folder for new project (**MODEL > New project**).

Spacing tables will be written to four files and contain information on distribution of spacings (distances, increments) for frames (file with extension .&sp), design sections (file with extension .&st), buttocks (file with extension .&bp), waterlines (file with extension .&wp). They are used for abscissae, ordinates and applicates calculations by layer names. For proper initialization there

must be data for buttocks both with positive numbers (starboard side) and with negative numbers (portside), e.g. from -5 to 5). Outmost lines must be outside hull forms. The same is extended to upper waterlines. For reducing work it is recommended to use spacing 1000 mm for buttocks and for waterlines files.

Then use menu item **MODEL > Spacing tables**. Here are sample names for spacing files (project 28123): *28123.&sp*, *28123.&st*, *28123.&bp*, *28123.&wp*.

8.3. Filling model

Hull model is a special DWG file with required organization. Model is a three dimensional wireframe and is created in WCS and in ship UCSs.

User coordinate system origin coincides with intersection point of three main planes with zero abssicca, zero ordinate and with zero applicate (usually they are planes of frame 0, waterline 0 and buttock 0). For work with model there are needed ship coordinate systems (UCS): World (WCS, identic to UCS KOR), BAT (plane XY coincides with the center line buttock plane), WL (plane XY coincides with zero waterline plane).

To start filling model having N-Ship structure it is necessary to run command INSERT and to insert DXF file (e.g. *29123.dxf*) or DWG file (e.g. *28123.dwg*):

- model block must be exploded;
- nanoCAD axis Z must go along axis X of the ship (positive direction is from aft to fore);
- nanoCAD axis Y must go along axis Z of the ship;
- nanoCAD axis X must be directed to ship's portside;
- view direction in WCS plan must correspond to view from the end of ship axis X to the body plan plane.

To correct model lines commands ALIGN and ROTATE3D can be applied.

For model initialization menu item **MODEL > INITIALIZATION > Full initialization of model** is to be used. This operation will create ship UCSs, views and viewports. Ship views KOR (body plan), BOK (elevation view), PSH (view to base plane) and TZ (isometry). Moreover, one, two, three and four screen viewport configurations KOR, BOK, PSH, TZ, PB, PK, TBK, TPK, TPBK are created too. All these views and viewports are accessible from toolbar **Projections**.

All the model lines must be located on specially named layers. To set layer names it is necessary:

- to set current values of partition and subpartition (for hull forms they are 0 and 0), with menu item **MODEL > Partition and subpartition**;
- with menu item **MODEL > Line names** to rename layers for frames (for example *_FR28_0_0_*, *_FR52\$150_0_0_*, etc.); the same for layers of waterlines, buttocks and other ship lines.

To automatically convert 2D drawing with named layers of body plan to 3D drawing use menu item **MODEL > ADAPTATION > Adapt model to layers**. As a result of this command all the

frame lines will be moved to their abscissae (elevations), as well as waterlines and buttocks, according to names and coordinates calculated by spacing tables.

Model extension can be made with modules **Structure** (lines of decks, platforms, longitudinal bulkheads, longitudinal girders, other structures), **Mdet** (auxiliary structure lines of various types). Model file will be further applied for parts geometry forming and saving (module **Part**).