

# ShipConstructor Community Tools

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## About ShipConstructor Community Tools

ShipConstructor Community Tools (the Tools) is an open-source not-for-profit initiative entirely driven by individual enthusiasts (the Creators) and owned by the Community as a whole. As a legal entity, ShipConstructor Software Inc. (SSI) has no ties with this project.

The sole purpose behind ShipConstructor Community Tools is to let people play, experiment and create in a safe environment that promotes innovation, welcomes idea exploration, quick prototyping, collaboration and knowledge sharing.

All software code and other materials originating under the Tools are automatically licensed under an open-source licensing agreement according to which the copyright holder provides the rights to study, change, and distribute the product to anyone and for any purpose, including possible commercial and non-commercial uses. All rights are granted free of charge and free of any conditions.

For more information on licensing, please refer to the license file included with each release.

## Disclosure of Risks and Liabilities

- ShipConstructor Community Tools are created by enthusiasts of unknown qualifications.
- All tools should be treated as prototypes of highly-experimental nature.
- Use of Community Tools may irreversibly damage your files.
- Use of Community Tools may irreversibly corrupt your ShipConstructor project database.
- Use of Community Tools may lead to other negative consequences resulting in financial losses.
- Everything is made available “as is” with no guarantee of correctness, future maintenance, continued support or anything at all.

## Liability Waiver

By using ShipConstructor Community Tools, you confirm:

- That you fully understood inherent dangers and risks;
- That you use the Tools at your own risk while assuming the full responsibility for your actions;
- That you free the Creators from all liability for any damages or losses resulting from using ShipConstructor Community Tools;
- That you waive your right to initiate a legal action against the Creators.

You also agree to not hold ShipConstructor Software Inc. (SSI) liable for any negative consequences resulting from use of ShipConstructor Community Tools.

## Ways for You to Contribute

There are several possible ways for you to contribute to the development of ShipConstructor Community Tools. If you possess sufficient programming skills, you are very welcome to request access to the GitHub project and write your own extensions for the Community Tools.

If you are not a software developer, but a shipbuilding specialist or an engineer we will be happy to listen to your feedback and ideas on developing new tools and improving existing ones.

The location for the open-source project: <https://github.com/ichudakov/SCCommTools>

## Technical Summary

ShipConstructor Community Tools are comprised of the following:

- AutoCAD scripts written in LISP and VBA;
- AutoCAD partial customization file (\*.cuix) that provides some AutoCAD interface;
- Macro-enabled Excel documents; and
- General documentation.

Presently, the source code behind Community Tools commands does not rely on a direct data exchange with the ShipConstructor project database, and the ShipConstructor API is not used either.

As much as possible, all features are designed to rely on native AutoCAD commands and Microsoft Excel functionality alone.

The current philosophy behind ShipConstructor Community Tools is to only automate those operations that the user can, theoretically, perform themselves manually inside an AutoCAD drawing or an Excel workbook. This approach is to ensure an additional degree of safety and minimize risks of seriously corrupting your ShipConstructor project.

Please note, however, that the above approach is still not a 100% guarantee of safety. Unforeseen issues and unintended software behaviours may still occur.

## Installation Procedure

The installation instructions for ShipConstructor Community Tools are fairly simple, but they may vary depending on your work environment. The detailed instructions in this section are written for individual users who would like to install ShipConstructor Community Tools on their local workstations.

In case you are a CAD administrator who organizes work of multiple users, your instructions may be slightly different. There will be some ideas and recommendations shared along the way that you may find helpful.

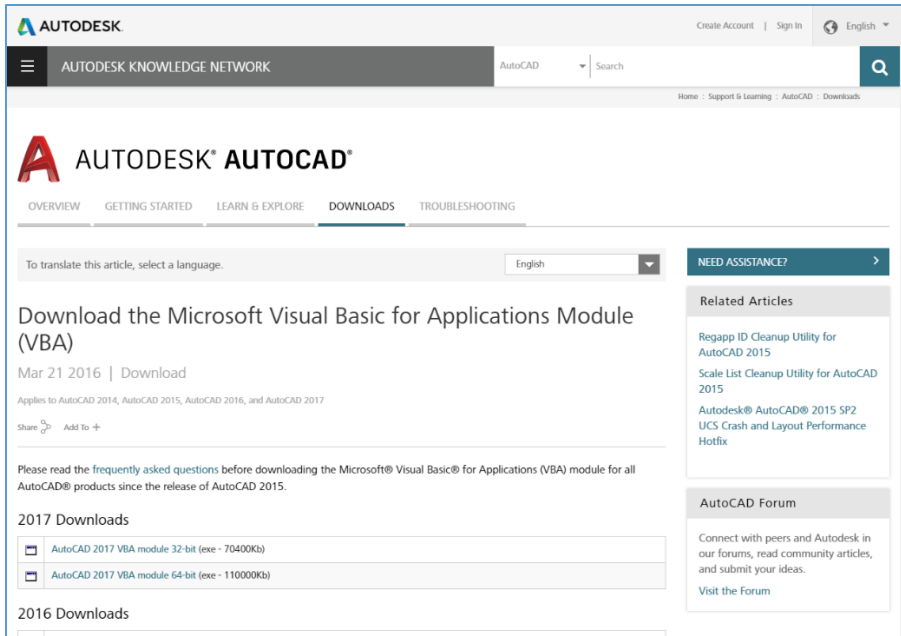
Note that most of the installation steps will only need to be repeated once. Performing a subsequent update of ShipConstructor Community Tools may be as simple as replacing a few files and restarting AutoCAD.

### Step 1: Install the VBA Module for AutoCAD

Install the **VBA Module for AutoCAD** that is consistent with your current AutoCAD version. Note that each version of AutoCAD requires its own VBA module.

The Module can be downloaded at the following link:

<https://knowledge.autodesk.com/support/autocad/downloads/caas/downloads/content/download-the-microsoft-visual-basic-for-applications-module-vba.html>



## Step 2: Install Microsoft Excel 2010 or Later Version

If you plan on using Community Tools for calculating ship weight distributions you will need to have Microsoft Excel 2010, or later version, installed on your computer.

Additionally, it is also recommended that you bring up Microsoft Excel security settings and allow running of VBA macros for macro-enabled workbooks.

## Step 3: Download and Unzip the Archive with ShipConstructor Community Tools

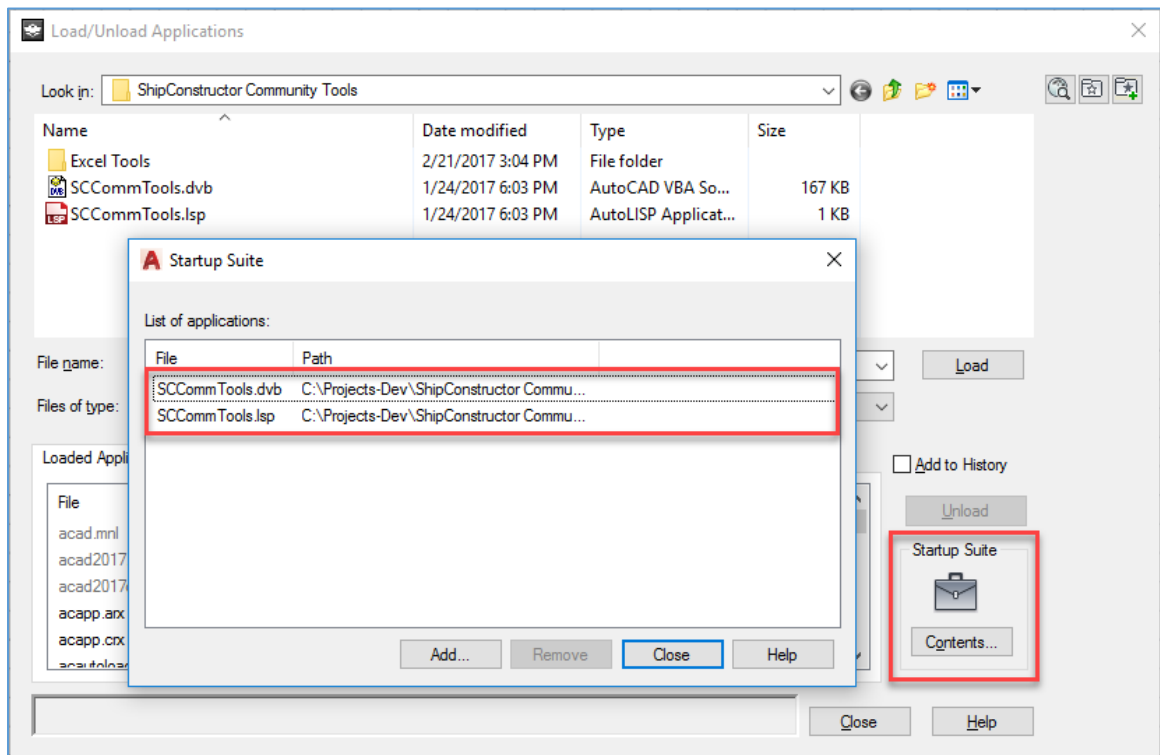
- Download the latest version of the ShipConstructor Community Tools archive from its network location. The download link is available on the cover page of this document at the very top.
- Unzip the files to a folder that will become a permanent location.

Note that the folder does not have to be local. If you are a CAD administrator who is organizing the environment for multiple users, you may deploy the Tools to a shared centralized location. This will significantly simplify future updates procedure.

## Step 4: Add \*.dvb and \*.lsp Files to AutoCAD Startup Suite

- Start your **AutoCAD**.
- Type **APPLOAD** in the AutoCAD command line.
- Under **Startup Suite**, click **Contents...**
- Navigate to the folder where you unzipped the files.

- Add the two files, **SCommTools.dvb** and **SCommTools.lsp**, to the AutoCAD Startup Suite:



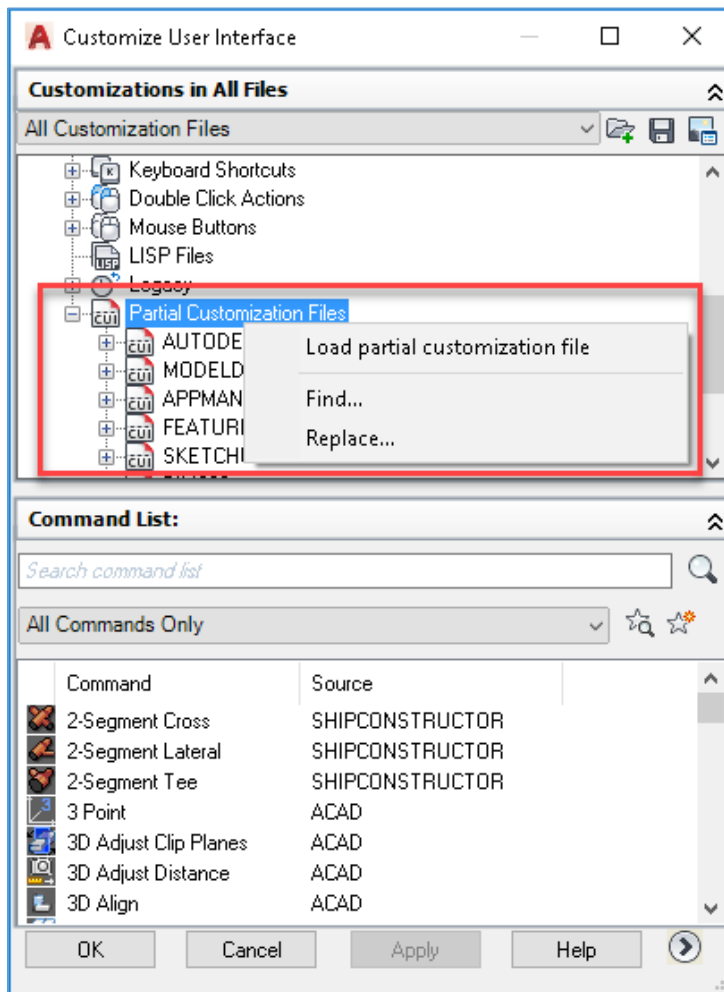
- Apply all changes.

Adding the files to the **Startup Suite** should immediately load them into your current AutoCAD session. Also, if you restart the application, AutoCAD will be automatically loading these files in the future.

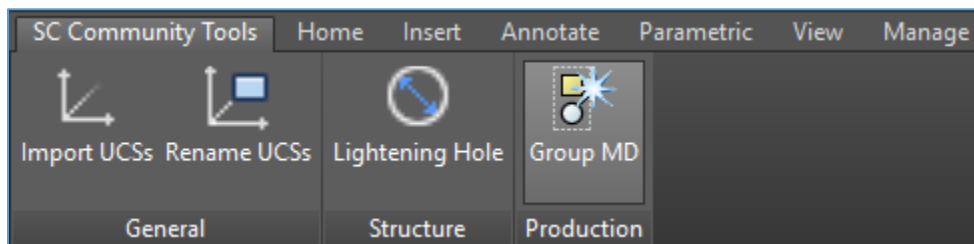
## Step 5: Load User Interface from the Partial Customization File

- Type the **CUI** command in the AutoCAD command line.
- Select **Partial Customization Files** in the tree in the upper half of the dialog.

- Right click the selection, and choose **Load partial customization file**:



- Navigate to the **SCCommTools.cuix** file.
- Click **OK** to close the dialog.
- You should notice the new **SC Community Tools** ribbon tab, menu and toolbar:





# Custom Commands for AutoCAD

## General Commands

### Import UCS List (CTIMPORTUCSLIST)

The **CTIMPORTUCSLIST** command imports all User Coordinate Systems (UCS) from an external \*.dwg file into the current drawing. If a similarly named UCS already exists in the current drawing, the import for that UCS will be skipped.

### Rename UCS List (CTRENAMEUCSLIST)

The **CTRENAMEUCSLIST** command does batch-renaming for UCS that reside in the current drawing. Caution should be exercised when using this command as it might significantly change names of multiple UCSs. Restoring the names back to their original state may not be easy. To perform the renaming:

- Run the CTRENAMEUCSLIST command;
- Enter the sequence of characters to be replaced in each UCS's name;
- Enter a new sequence of characters with which to replace the previous sequence;
- Complete the operation.

## Structure Commands

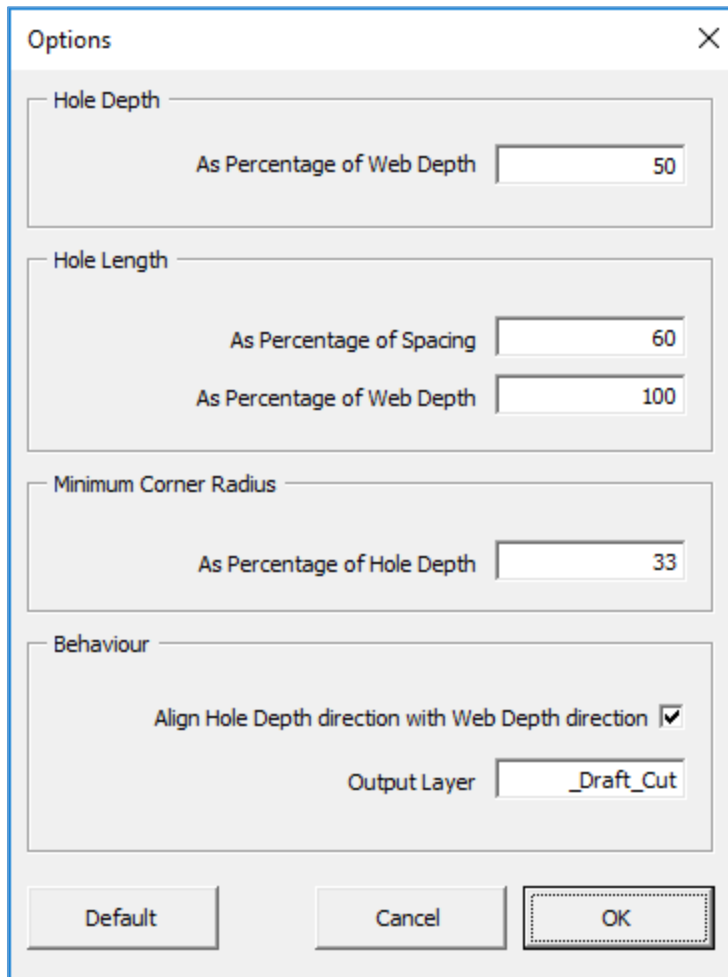
### Lightening Hole (CTLIGHTHOLE)

The **CTLIGHTHOLE** command produces reference geometry such as rounded rectangles represented by closed AutoCAD polylines that can be used for creating some types of lightening holes. The command can be configured to place its output on the **\_Draft\_Cut** layer, or any other layer of choice. To create an actual lightening hole, the **SCADDOBJECTTOSTRUCTPART** command will need to run on the reference geometry.

#### Parameters

Lightening holes are created based on realistic engineering principles dealing with structural strength and integrity. Most the control parameters are defined relative to the surrounding structure. Where applicable and as applicable, the definitions are consistent with common Lloyd's and ABS rules.

The actual values for the parameters can be adjusted by the user to meet the specific requirements for a particular type of vessel. For example, smaller lightening holes may be preferred for navy vessels while large ones may be more suitable for racing yachts.



The image shows a software dialog box titled "Options" with a close button (X) in the top right corner. The dialog is organized into four sections, each with a title bar and a set of controls:

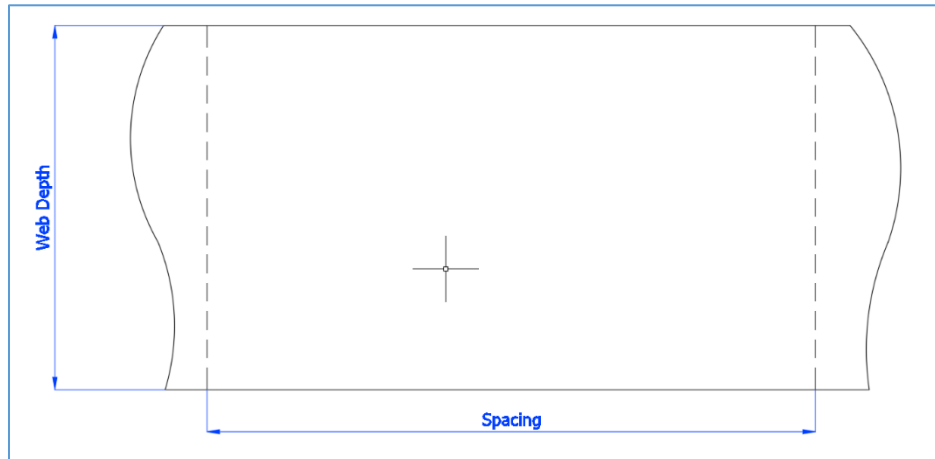
- Hole Depth**: Contains a label "As Percentage of Web Depth" and a text input field with the value "50".
- Hole Length**: Contains two labels and text input fields: "As Percentage of Spacing" with the value "60", and "As Percentage of Web Depth" with the value "100".
- Minimum Corner Radius**: Contains a label "As Percentage of Hole Depth" and a text input field with the value "33".
- Behaviour**: Contains a checked checkbox labeled "Align Hole Depth direction with Web Depth direction" and a label "Output Layer" with a text input field containing the value "\_Draft\_Cut".

At the bottom of the dialog are three buttons: "Default", "Cancel", and "OK". The "OK" button is highlighted with a dashed border.

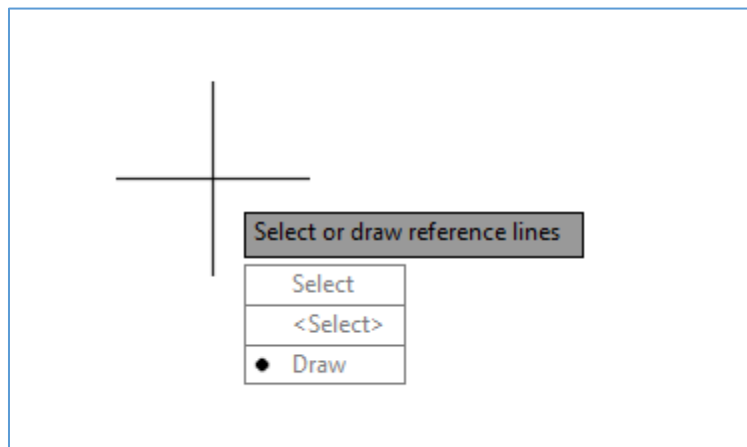
### Sample Workflow

There are several possible ways to use the **Lightening Hole** command. As one quick example of using the functionality:

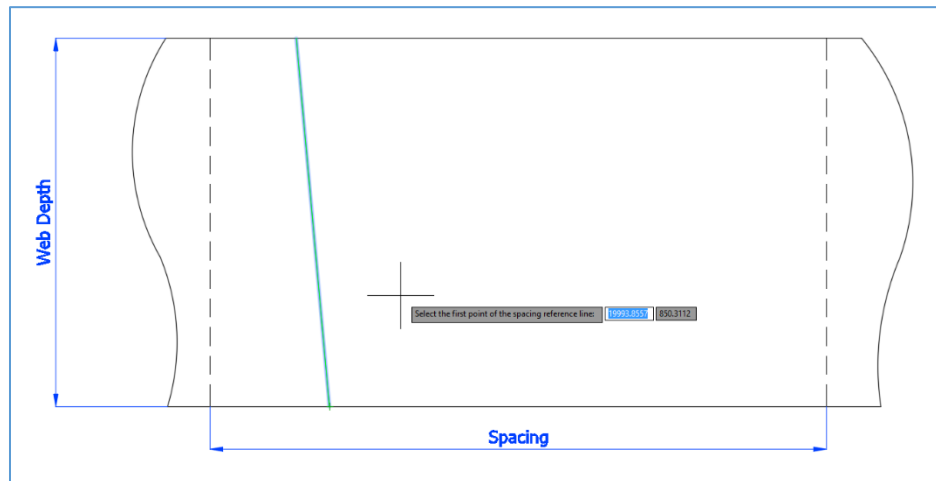
- Locate a structural web in your drawing and identify its depth and available spacing.



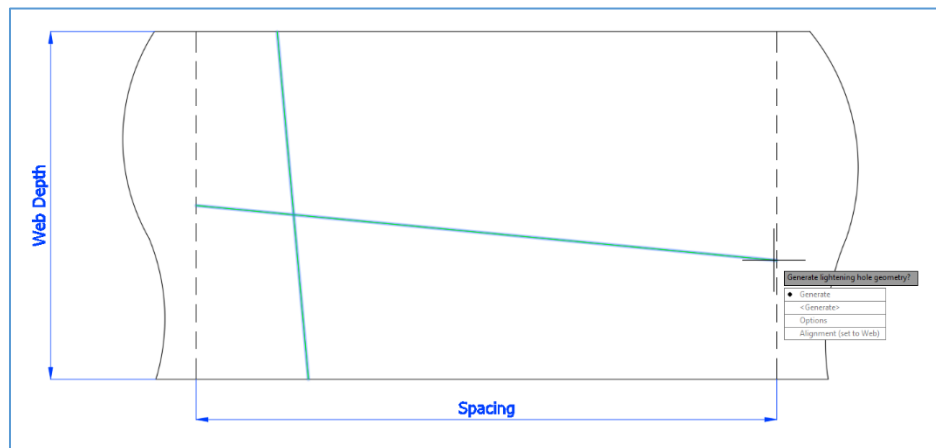
- Run the **CTLIGHTHOLE** command.
- Select the **Draw** option:



- Select two points on the opposite edges of the web to draw the first reference line measuring the web depth. Note that the reference line does not need to be ideally vertical:

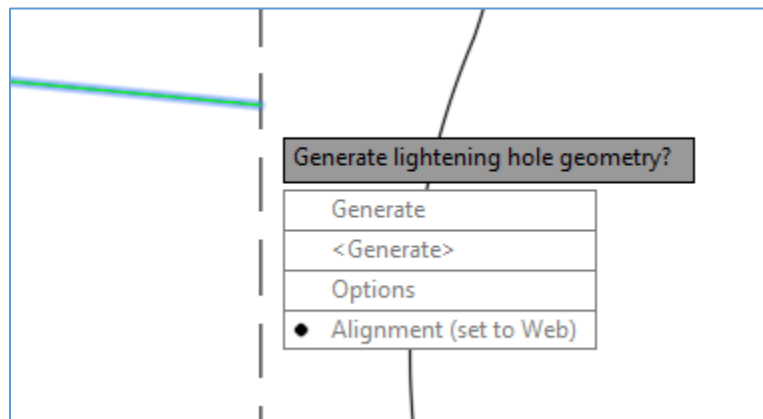


- Select the next two points to draw the second reference lines to indicate the spacing available. Note that the reference line does not need to be ideally horizontal:

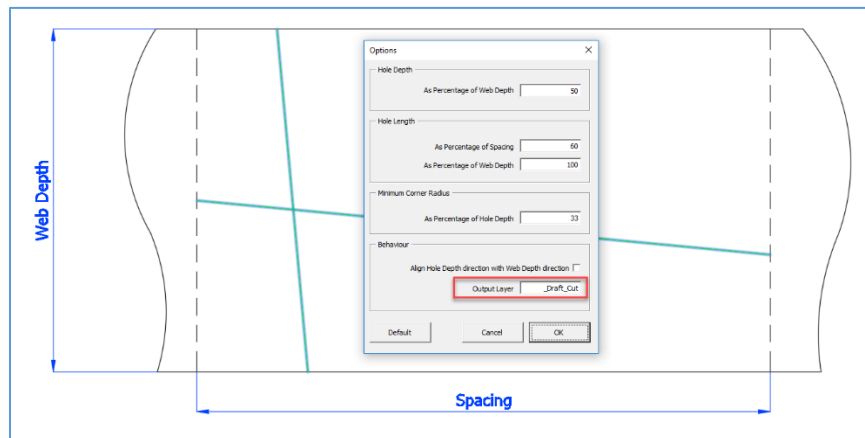


- Ensure that the **Alignment** parameter is **set to UCS**. This will guarantee that the hole is rotated consistently with the current UCS's axes directions.

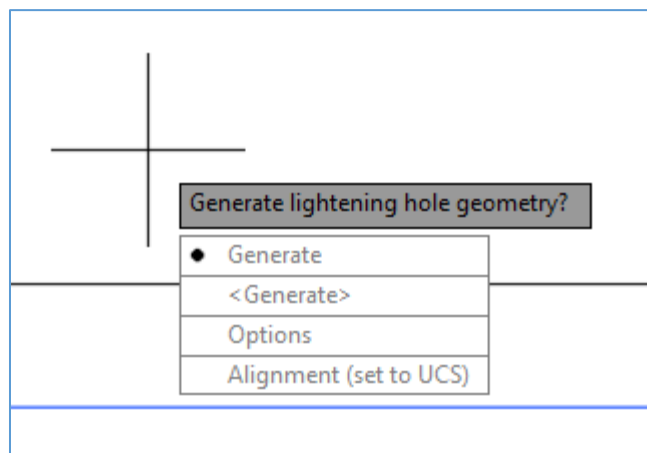
- Notice that you can change the **Alignment** at any time if necessary, but don't do it now:



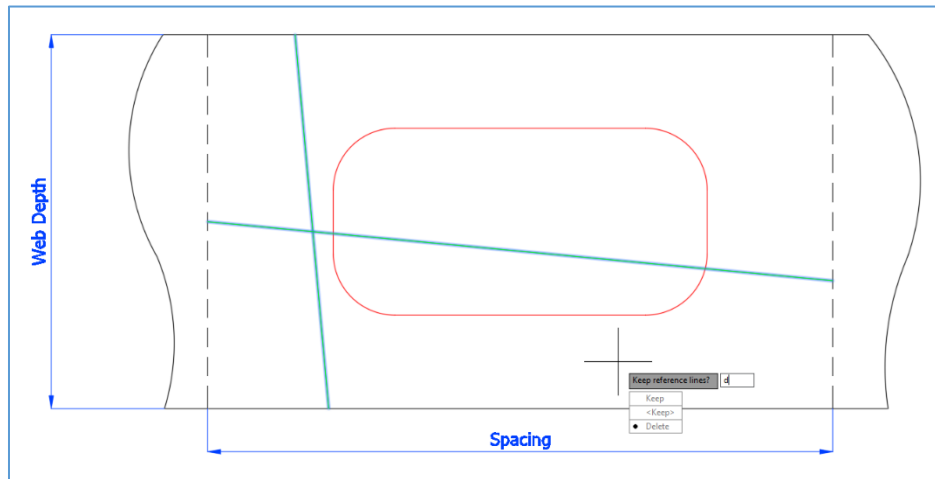
- Choose **Options** and review other parameters controlling the geometry. Notice the **Output Layer** for the resulting polyline:



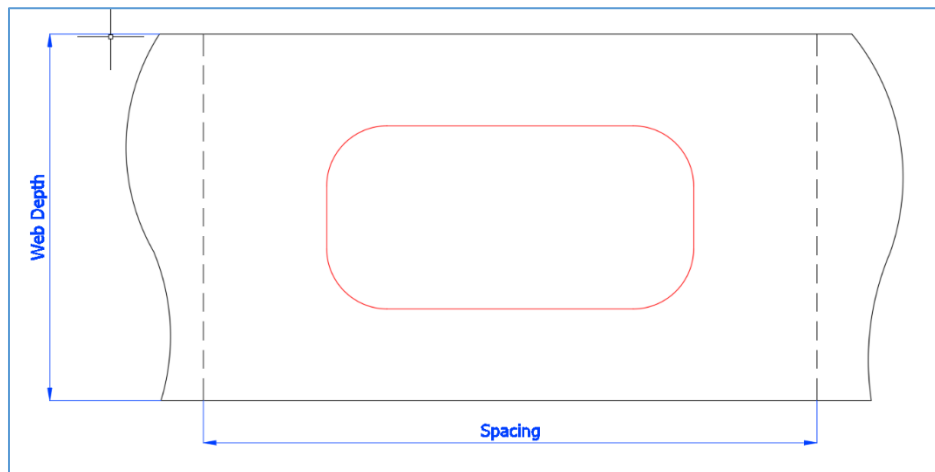
- Click **OK** to close the Options dialog.
- Use **Generate** to create the closed polyline representing the lightening hole:



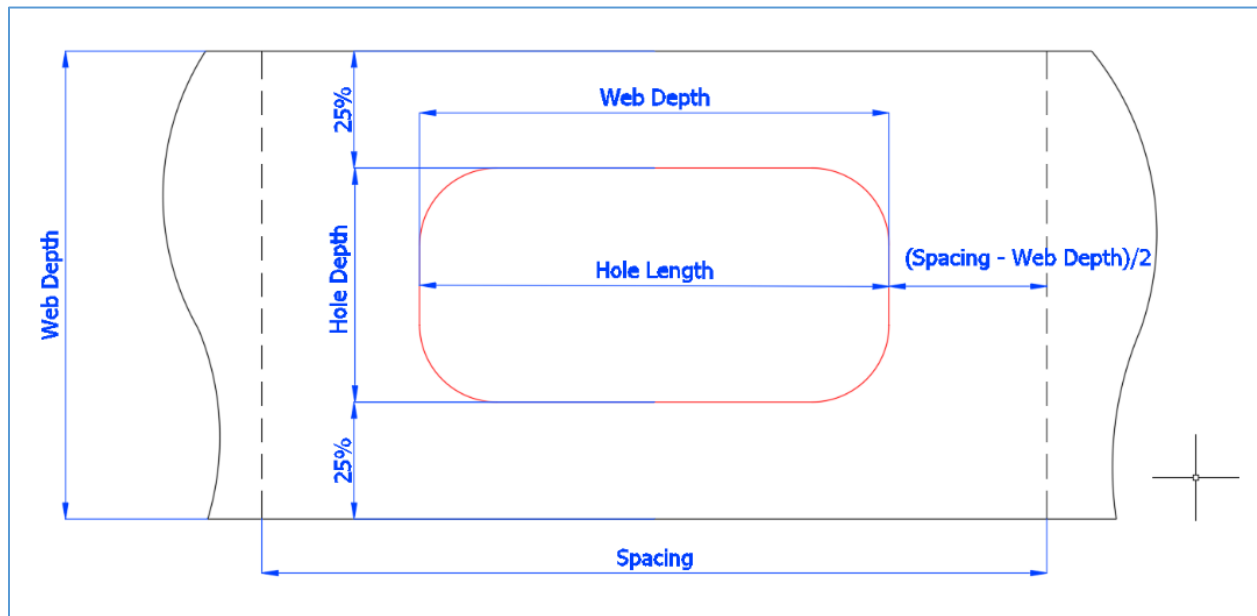
- **Delete** the reference lines unless you need to keep them for some reason:



- Once the operation is complete, the final result may appear as follows:



- If you dimension the final output, you may be able to see the following:

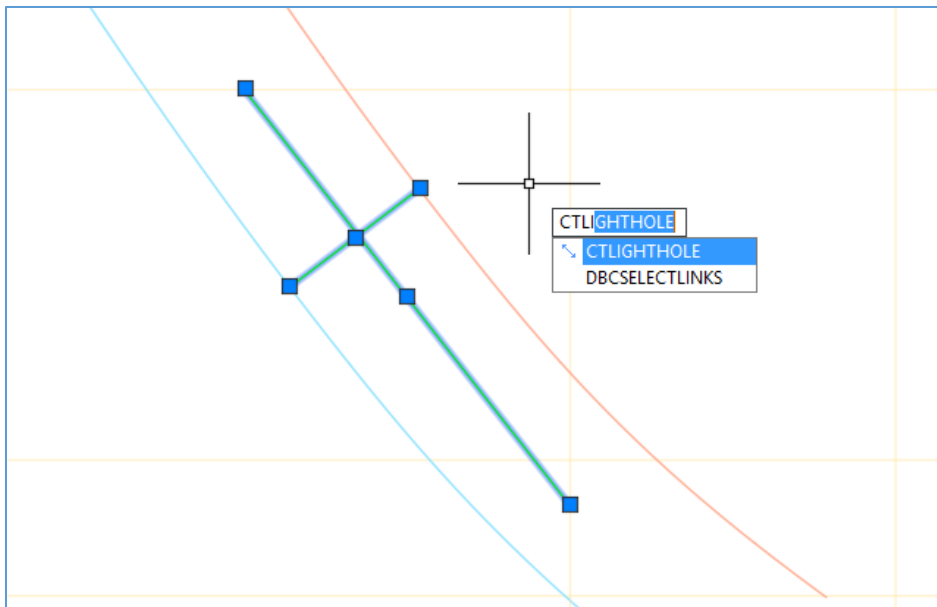


- The hole is positioned in the middle of the structural web and centered relative to the available spacing;
- The hole is oriented parallel to the axes of the current UCS;
- The hole depth is the percentage of the total web depth specified in the command options;
- The hole length equals to the lesser of the two: 1) the web depth, or 2) the percentage of the spacing distance set in the command options; and
- The corner radius for the hole is a percentage of the hole depth as per command options. Note that the radius can be increased up to 50% to make the hole even more rounded.

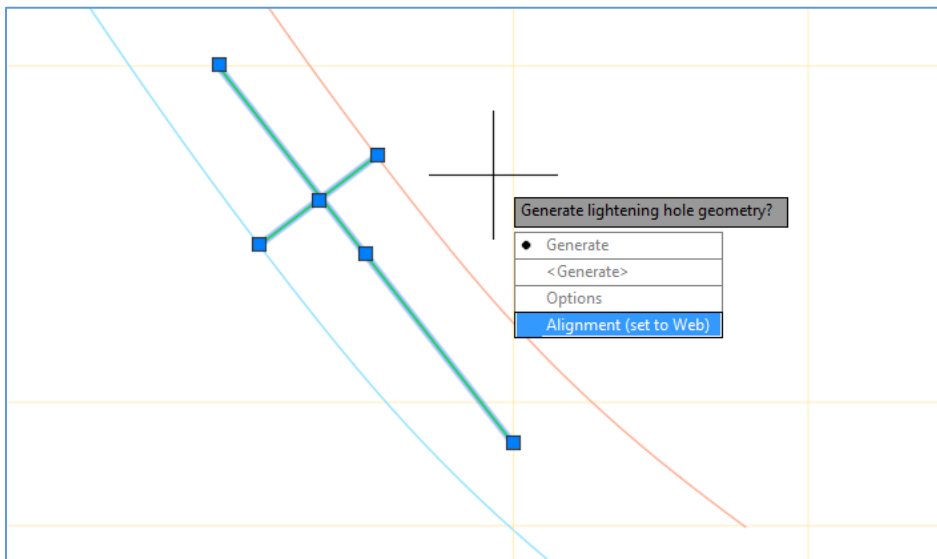
#### *Other Ways to Use the Command*

In the previous example, we drew the two reference lines measuring the web and spacing distance. Sometimes, you may have such lines created ahead of time. If this happens to be the case, you can simply select the lines either before or after running the **SCLIGHTHOLE** command.

Note that Web Depth line needs to be selected first and then, the spacing line:

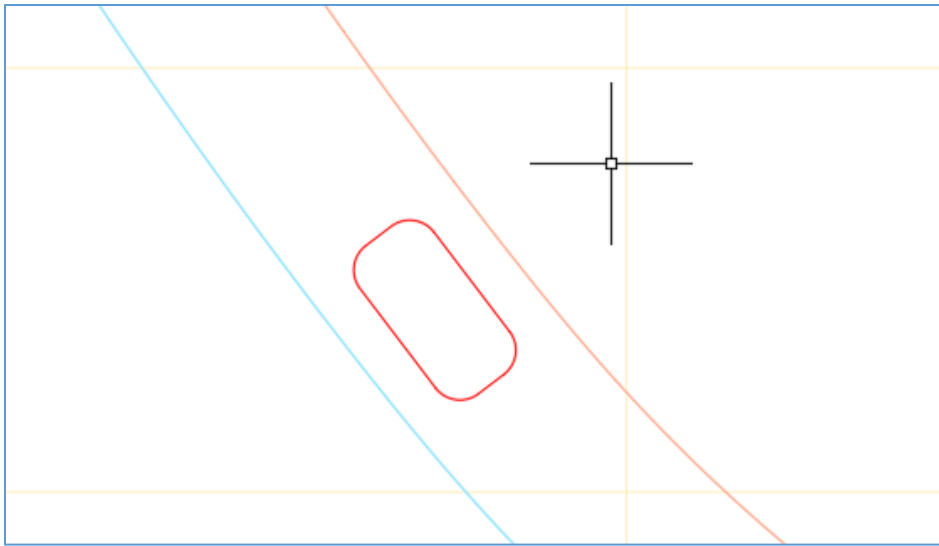


The **Alignment** parameter can be changed so that the hole is aligned relative to the web-depth line instead of the current UCS:

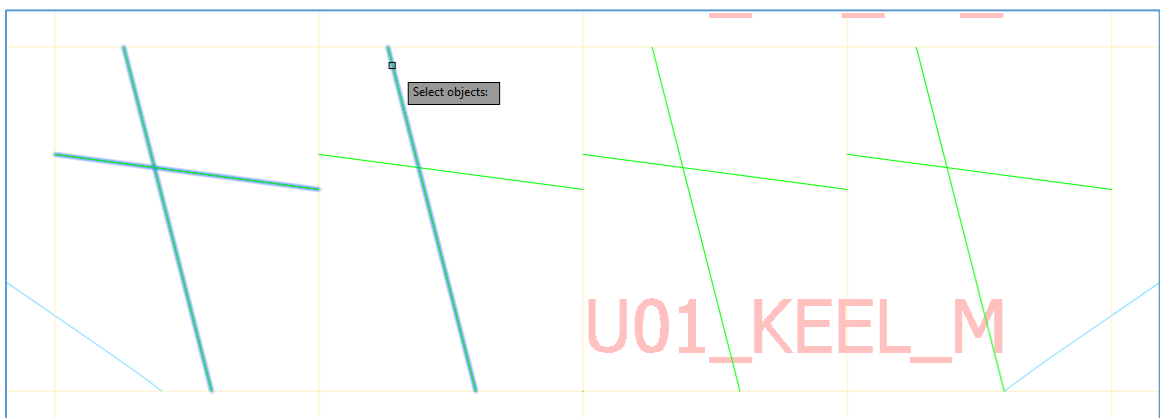




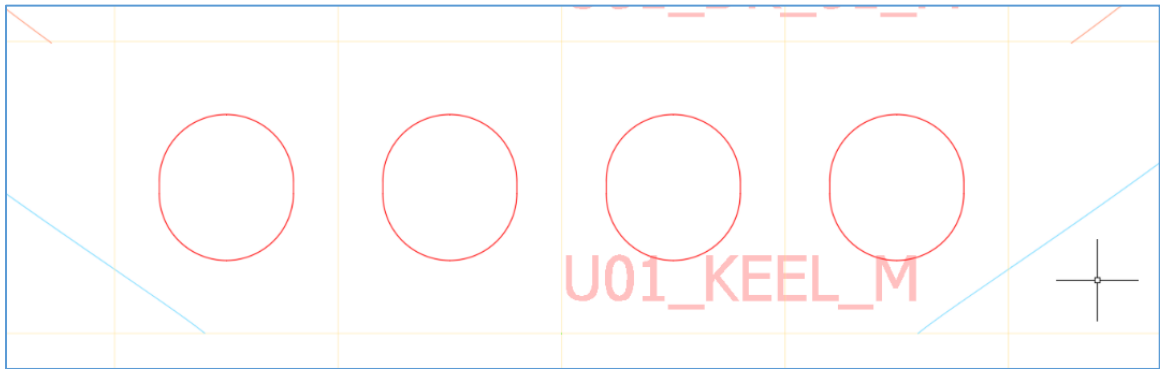
This option can be handy when placing lightening holes at an angle:



Finally, multiple lightening holes can be created in a batch operation. All you need to do is to select multiple pairs of reference lines as an input to the command. Remember that for each pair of lines, the web depth line needs to be selected first:



After all pairs of reference lines are selected in the correct order, running **Generate** will produce multiple polylines:

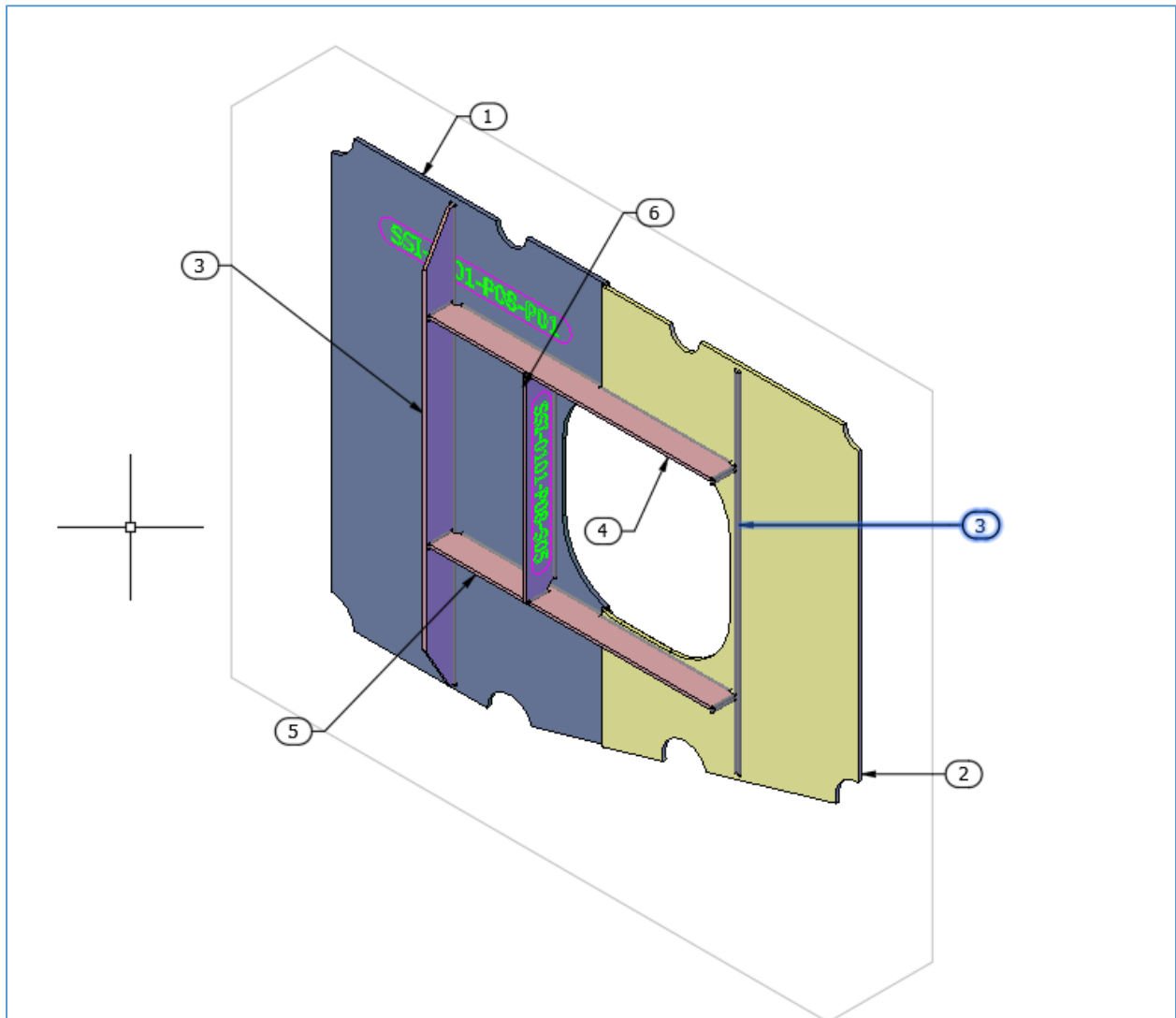


## Production Commands

### Highlight Orphaned Labels (CTLABELHIGHLIGHTORPHANED)

The command *highlights* all “orphaned” labels that have lost their association with the original BOM table on the current layout. Such labels may happen as a result of the user copying (CTRL+C) and pasting (CTRL+V) labels in a production drawing, which is not a recommended ShipConstructor workflow for labels.

The danger of having orphaned labels in your drawing is that they don’t update properly and can be easily mistaken for legitimate labels:



## Group MarineDrafting Objects (CTMDGROUPOBJECTS)

This command is for application inside MarineDrafting views containing 2D representations of the 3D model. The command joins isolated bits and pieces of the MarineDrafting geometry into AutoCAD Groups.

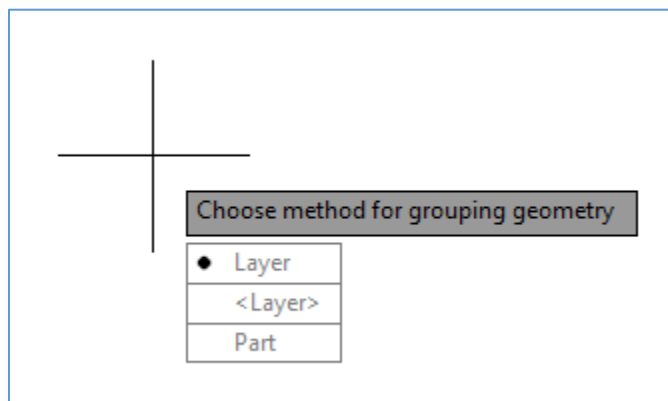
Currently, there are two options that control the consolidating behaviour:

- **Forming AutoCAD Groups by Part** – all bits and pieces of the geometry that belong to the same part become one AutoCAD Group;
- **Forming AutoCAD Groups by Part and Layer** – all bits and pieces of the geometry that belong to the same part and reside on the same layer become one AutoCAD group.

The benefit of having related 2D geometry consolidated into groups is that it makes performing certain operations much faster and easier. For example, if you decide to delete an entire part from the 2D view, you can do it in one step by deleting the AutoCAD group that joins all bits and pieces of the geometry for that part together. There will be no need to click every single bit of geometry one by one to remove the part. The same applies when you need to remove invisible portions of a part from the drawing. In this case, you can apply grouping by part and by layer and then, simply delete all groups that consolidate geometry on invisible layers.

To use the command:

- Open a MarineDrafting drawing.
- Run **CTMDGROUPOBJECTS**.
- Select all or some MarineDrafting views. If you are selecting some of the views only, please ensure that you click on any geometric object inside that view.
- Choose the method for grouping objects:



- Complete the command.

Note that after the command has finished, all items affected by the grouping command will be become modified elements in terms of MarineDrafting. There will be some changes in the update behavior for the affected parts. Also all affected geometry will be copied to the invisible **SCMD Original** layer. More information on the behaviour of modified parts in MarineDrafting views is available from the ShipConstructor product manual.

To release all groups in the drawing:

- Run the **CTMDGROUPOBJECTS** command.
- Select **More...**
- Choose **Reset All Groups in Drawing**.

All groups in all MarineDrafting views will be released.

## Analysis Commands

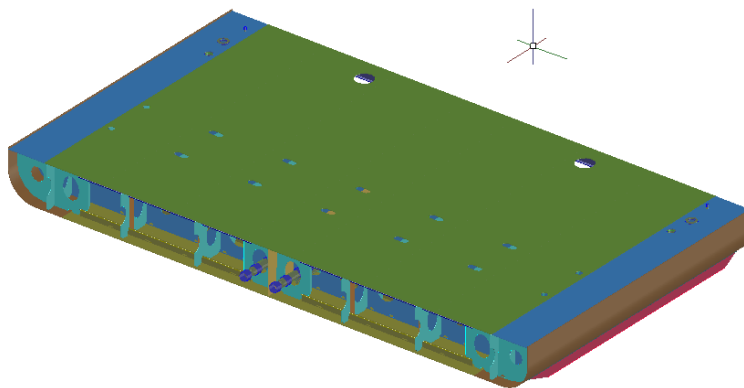
### Space Bomb (CTSPACEBOMB)

The Space Bomb command calculates the volume of empty space inside an enclosed area. It only works with AutoCAD 3D solids and is only capable of processing one enclosed area at a time.

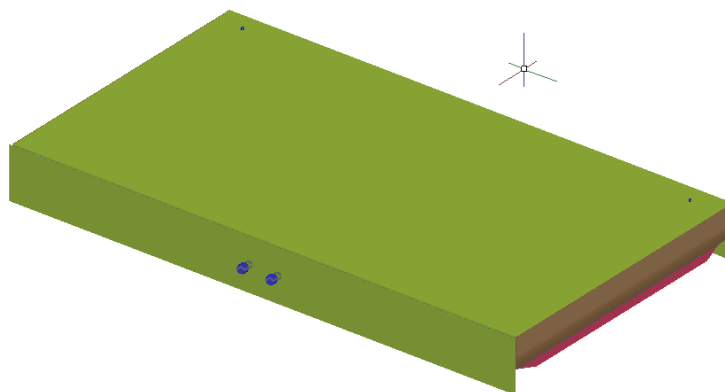
The recommended workflow for using this command is as follows:

- Create a non-model ShipConstructor drawing where assemble all parts comprising an enclosed area for which an internal volume needs to be estimated.

An Output drawing would be a convenient drawing type to use for this purpose:



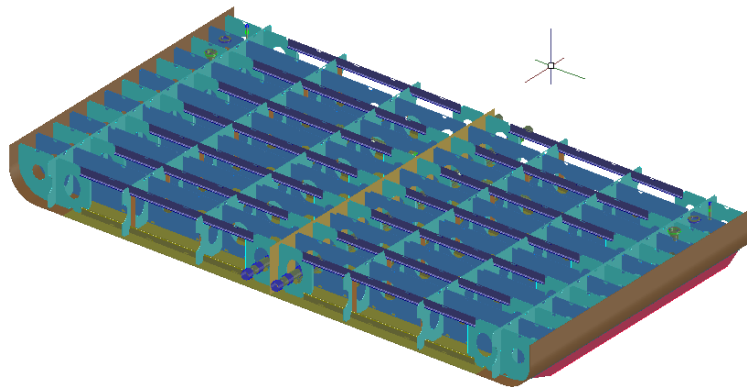
- Explode all parts into native 3D solids. Note that because you are not working in the model drawing, this action parts will not affect anything in your project 3D model.
- If some parts in your 3D model have small holes or cutouts, model additional solids to completely seal off all access to the inner space of the enclosed area, especially from the side faces:



Note that for the correct operation of the command is it **very important** that all openings located on side faces of the 3D model are covered.

The only holes and cutouts that are not required to be covered are the ones located on the **Top** and **Bottom** faces of the enclosed space as long as these holes are planar and parallel to the XY plane in WCS. If in doubt, it will be best to close off the 3D model from all sides.

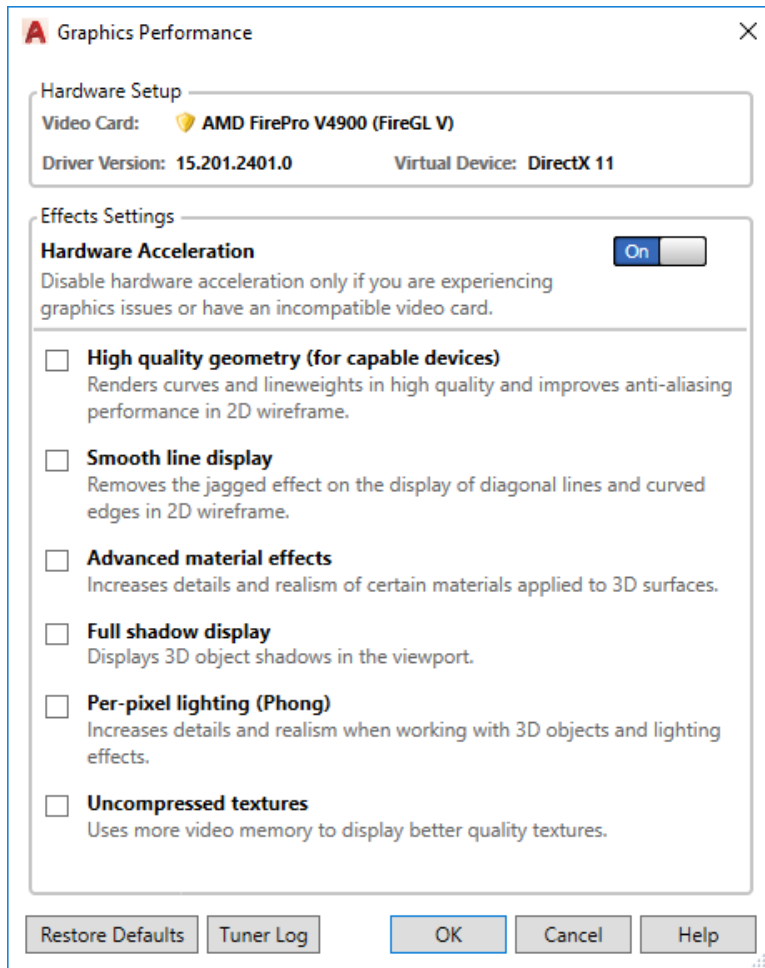
- The extra covers can be modeled on separate layers.
- If you like watching the progress of how the enclosed space gets filled by the Space Bomb command, you can turn off the layer visibility for the extra covers, or anything that obstructs the view:



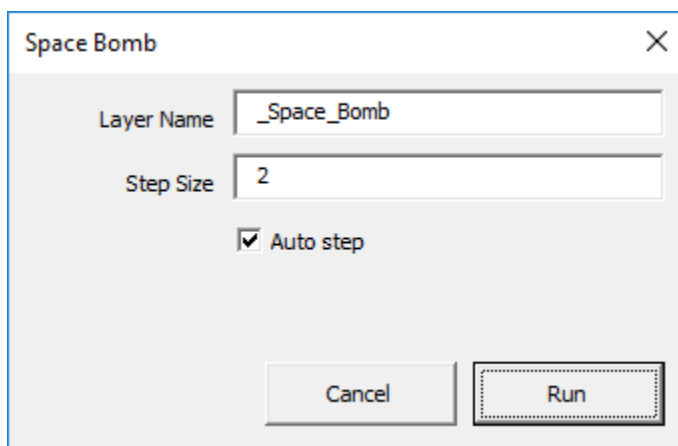
- As a final check before running the command, ensure that the drawing Visual Style is set to something that performs fast. The recommended styles are Wireframe or Shaded.

You can also turn off all of the fancy graphics settings in AutoCAD display options and set the VIEWRES variable to 1,000, or something close.

**Do not** disable hardware acceleration:



- Run the CTSPACEBOMB command.
- Modify the parameters as needed:



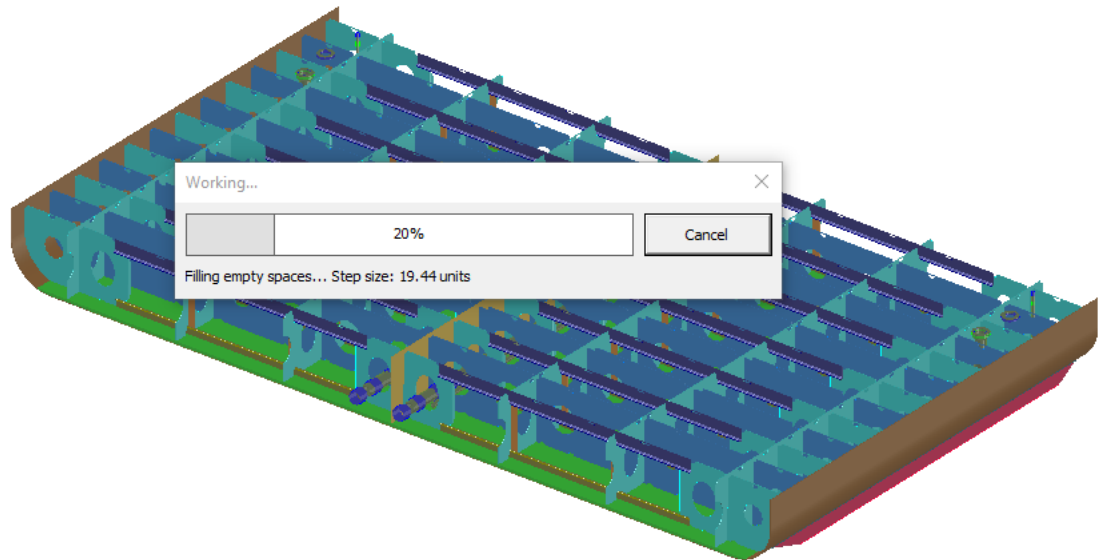
Note that you can manually control the Step Size used by the Space Bomb algorithm, or let the command set the value automatically.



The smaller step size will cause longer processing times, but the accuracy will be higher. If accuracy is important, it will be better to provide the value manually.

The auto-step option will determine the step automatically relative to the vertical size of the 3D model. This option is not geared for precision, but it is good for quick estimates.

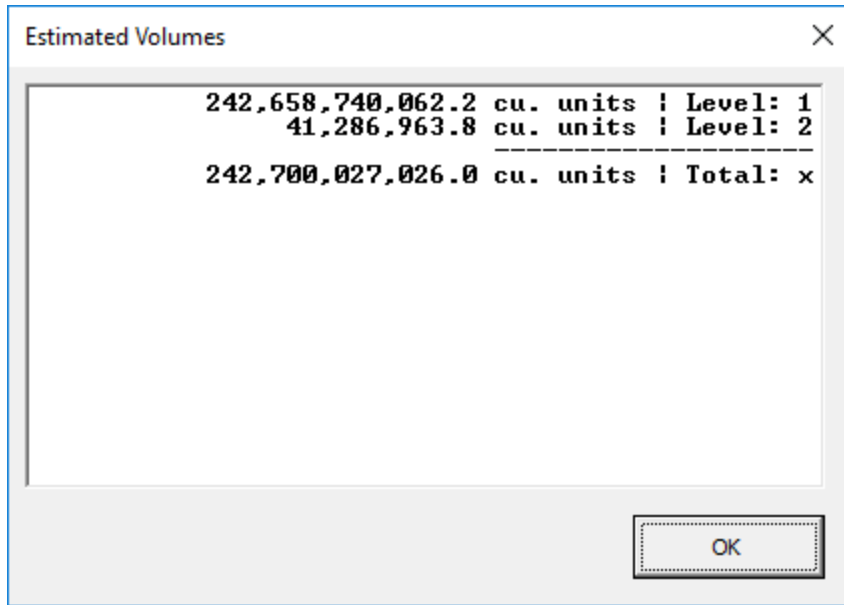
- Click the **Run** button and let the process complete. Depending on the size of the 3D model the processing time may take anywhere from a few seconds to a few hours:



The command has its limitations and you should be using common sense when applying it. Trying to run it on the entire bilge area of a large ship may not be such a great idea. It may be better to subdivide it into a few sections.

Note that if you realize that the process is likely to take more time than you initially anticipated, you can abort the operation at any moment and restart it with a larger step, perhaps.

- Once the operation is complete, you will see the Results window. The results will show volumes for empty spaces discovered inside the enclosed 3D model you provided:



Use the results window to copy and paste the data to anywhere you like. If you accidentally close the results window, you should still be able to retrieve the same details from the AutoCAD command line history, but you may need to scroll the output up.

The last option for retrieving the data is that the resulting 3D solids that fills up the empty spaces will remain in your drawing until you delete them. You can select any solid and run **MASSPROP** on it to get the volume. Note that presence of large solids may slow down your drawing significantly, though.

- One more thing to mention about the results is that you may notice that volumes in the result records are broken down into “levels”.

For a simple 3D model, you should only expect one level of volumes; however, for spaces where nested watertight enclosures are present, there may be more than one level of volumes.

For example, there may be watertight a compartment that has a watertight tank inside it with some watertight tubing inside the watertight tank. In this case, you will get three levels for empty spaces:

- Level 1 - the volume inside the compartment, minus the tank.
- Level 2 - the volume inside the tank, minus the tubing.
- Level 3 - the volume inside the tubing.

There will also be a sum of all volumes provided in the results.

In the end of the day, it will be up to you how to interpret these figures as the tool wouldn't know. Also, when interpreting the results keep in mind that levels are also identified while looking inwards.

# Excel Tools

## Linear Weight Distributions (CTWeightCalculations.xlsm)

The **CTWeightCalculations.xlsm** macro-enabled Excel document included with ShipConstructor Community Tools allows you to quickly produce linear weight distributions for your ship along the longitudinal, transverse or vertical directions.

### *Recommended Workflow*

The recommended workflow for using the tool as follows:

- For all parts that participate in the weight model, extract your initial data from ShipConstructor or other sources and save it inside a separate Excel file. It does not matter as much what tools you use, or how exactly you create the source document. What matters most, however, is the presence of the required set of ten columns inside the spreadsheet. For each, part that participate in the weight model you must provide the following columns:
  - Weight
  - Longitudinal Coordinate for Center of Gravity (LCG)
  - Transverse Coordinate for Center of Gravity (LCG)
  - Vertical Coordinate for Center of Gravity (LCG)
  - Longitudinal Coordinate for Minimum Extent
  - Transverse Coordinate for Minimum Extent
  - Vertical Coordinate for Minimum Extent
  - Longitudinal Coordinate for Maximum Extent
  - Transverse Coordinate for Maximum Extent
  - Vertical Coordinate for Maximum Extent

For example, the below illustration shows an Excel spreadsheet generated with **PublisherLT** that contains all of the required data, plus some additional columns:

	A	B	C	D	E	F	G	H	I	J	K
	Part Guid	Part Name	Unit	TCG	VCG	LCG	Maximum Extent Long	Maximum Extent Trans	Maximum Extent Vert	Minimum Extent Long	Minimum Extent Trans
2	000076ee-89f6-408f-00904-122C-F1G4-09A-U_04-100-122C			3143	3435	11913	12000	4200	3730	11900	1905
3	000a211f-89e7-45df-00904-113C-F3G5-36A-U_04-100-113C			6996	7589	6609	6820	7000	7700	6307	6992
4	000c4771-a6b2-4e3a-00904-328P-F1G1-01A-U_04-300-320			8920	15447	32942	34423	8940	15933	31457	8900
5	000d38e0-5641-4c30-00904-135C-F2G1-23A-U_04-100-135C			-7682	12312	10151	12375	-7620	12325	7927	-7745
6	0011dcb5-fd63-4698-00904-311C-F1G2-02A-U_04-300-310			3825	1445	23085	23110	4060	1450	23060	3590
7	0012ad8b-f66a-4451-00904-133C-F1G4-15B-U_04-100-133C			7104	5508	16103	16106	7575	5753	16100	6960
8	001379f6-0135-41c8-00904-211C-F1G3-11A-U_04-200-211C			-6444	19958	3186	3500	-6440	16000	2846	-6448
9	001a2534-6da1-4f91-00904-113C-F3G2-27A-U_04-100-113C			5325	7862	-3247	-2835	5330	8200	-3500	5320
10	001b9476-765a-4486-00904-113C-F1G3-07J-U_04-100-113C			-3633	6697	2919	2988	-3607	7700	2808	-3640
11	001b9d26-ed4a-428f-00904-331C-F2G1-03B-U_04-300-330			2525	724	47219	52075	2530	1450	42325	2520
12	00225ed7-ca8f-40c9-00904-335S-F1G2-02A-U_04-300-330			-7737	5981	44209	44238	-7617	9900	44200	-7817
13	0022807c-dd58-44b6-00904-211C-F1G5-17A-U_04-200-211C			1251	13357	2930	2934	2412	13408	2926	28
14	0027aeea-5e91-4bb7-00904-411C-F2G1-04A-U_04-400-411C			-3137	773	92895	92900	-5	1450	92890	-6888
15	0028eid1-0dfc-4589-00904-375S-F2G2-11A-U_04-300-370			-8118	9287	83945	83950	-7615	10500	83940	-8814
16	003aaaf0f-9cd8-48f5-00904-315S-F1G3-03B-U_04-300-310			-8248	7625	24710	24715	-7819	7700	24705	-8678
17	0042561e-c1ce-48da-00904-114C-F2G3-18A-U_04-100-114C			-8733	7787	5604	5609	-8625	7908	5600	-8825

Note that the same document could have been produced with the help of ShipConstructor Reports, a direct Microsoft Excel query into the ShipConstructor database or by filling out each piece of data manually.

Also note that your ShipConstructor project database may not be the only available source of information. Some data may be added from your ERP system or other Excel documents. Generally speaking, it does not matter where the information is coming from as long as you can provide the minimum required set of parameters for each part.

- When developing your source Excel spreadsheet with weight data, note that the **Weight** attribute can mean different things. For instance, it can be the dry weight, wet weight, fluid weight, total weight or some other weight. The important part is to keep all weight information consistent across items in the dataset.
- Besides the key set of required columns, some additional attributes you may include into your source spreadsheet can be any descriptive properties such as Part Name, Stock Name, Stock Description and more.

The benefit of having this additional information inside the spreadsheet is that it helps you to search for and recognize individual parts in the dataset.

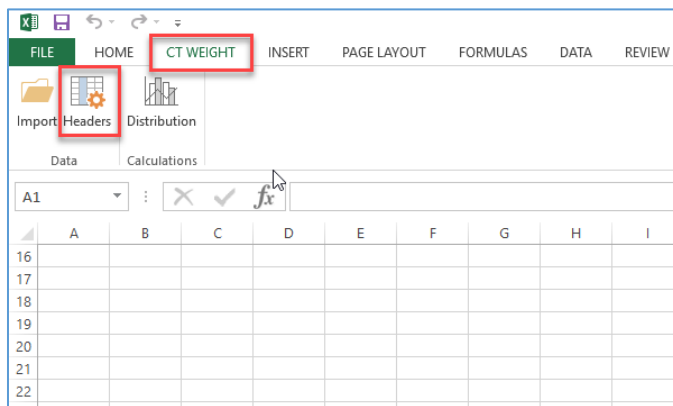
- The source data you provide may be stored on multiple sheets inside a single Microsoft Excel document, or it can be broken down into several Excel workbooks.
- When working with multiple spreadsheets, it is important to keep names of all columns identical across all sheets and workbooks you supply. Please, make sure that the text recorded in the very top cell of each column is the same for all columns containing similar type of data.

Note that the exact wording you may use in column headers is not that important. It is the consistency that matters. For instance, you can choose to name your Weight column such as

“Weight”, “Weight (kg)”, “W.” or something else. As long as that text does not change across similar columns located on different spreadsheets, the tool will work.

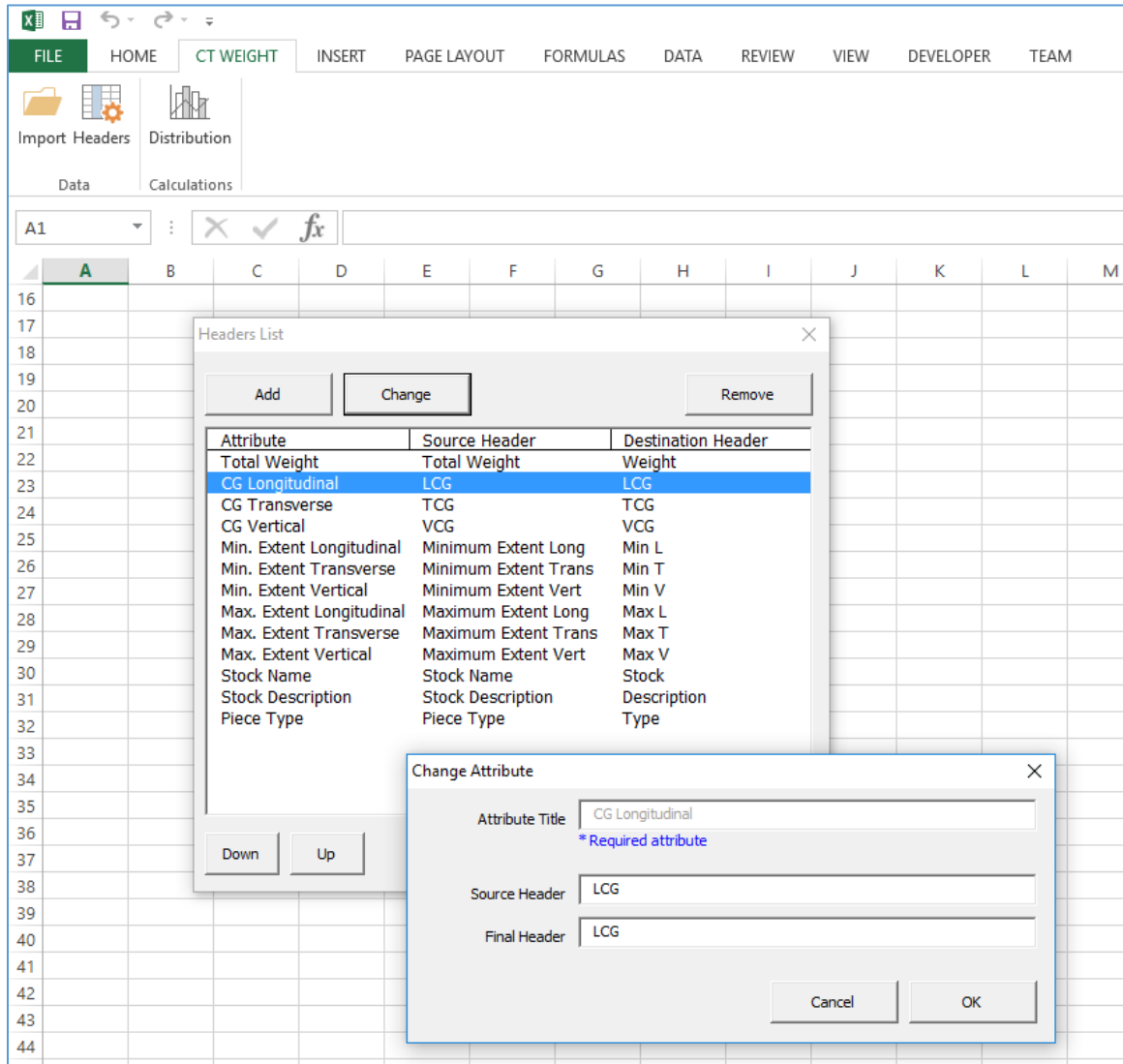
Also note that locations of individual columns inside your source spreadsheets are not important either. The Weight column may appear in the first position inside one table and the third position in another. It is the column headers that carry the primary importance. CTWeightCalculations.xlsm will rely on the headers to search for the right data on each sheet.

- After your source data sheet(s) is compiled, open the **CTWeightCalculations.xlsm** in Microsoft Excel.
- Ensure that macros are enabled. In later versions of Microsoft Excel, the macro settings can be located under: File > Options > Trust Center > Trust Center Settings > Macro Settings.
- Go to the custom **CT WEIGHT** tab on the ribbon and click the **Headers** button:



- You will see the complete list of columns that the CTWeightCalculations.xlsm will attempt to import from your source documents. The columns are listed in the same order in which they should appear at the destination location after the data is transferred.

- You can adjust and rename the headers as required. Basically, you specify which column to search for and transfer from your source location, and how to name these columns after moving the data to your destination location, which is CTWeightCalculations.xlsm. You can see it as a column mapping procedure:

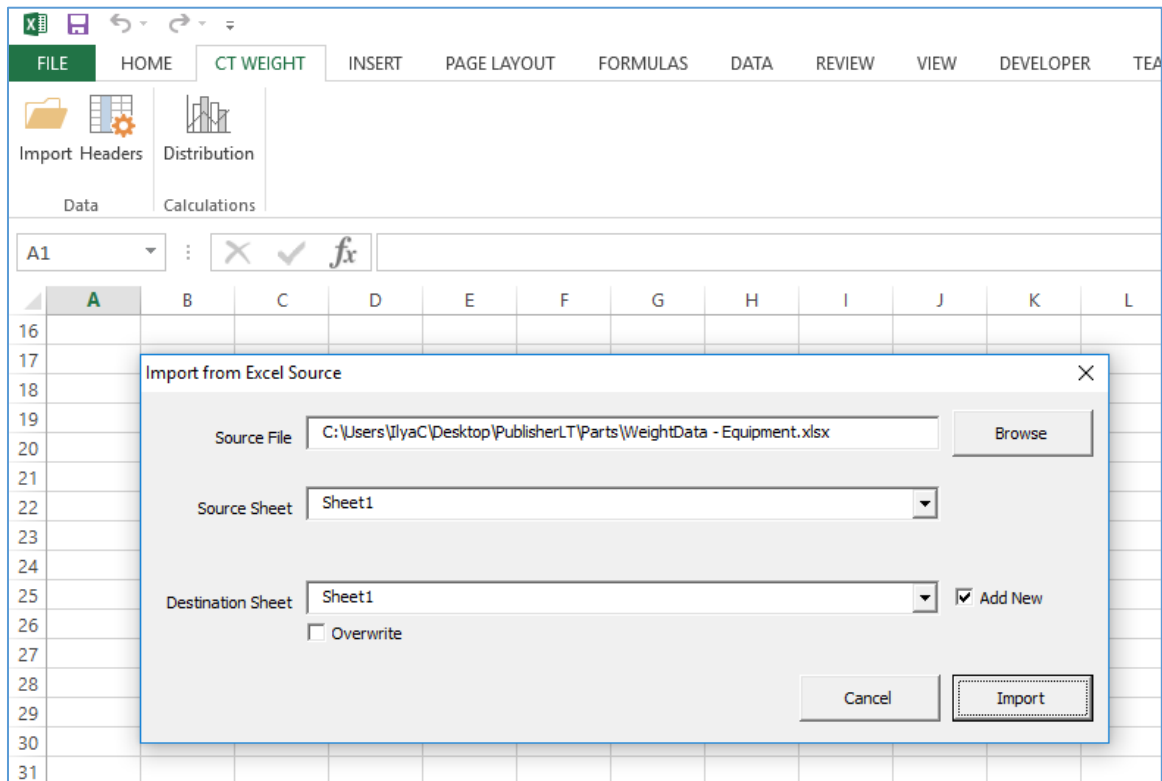


- Besides setting up the headers, you can also change the relative order in which columns should appear in your destination document, CTWeightCalculations.xlsm.

One requirement, however, is that the relative order in which columns appear inside CTWeightCalculations.xlsm should be set prior to importing your first set of data into this document.

- Finally, you can also add and remove some columns as need be. The only columns you cannot remove are the required attributes.
- After all headers and columns are set up, close the **Headers List** dialog.

- Click the **Import** button located next to the **Headers** button.
- Navigate to your source Excel file and select the specific sheet from which the data is to be transferred. Indicate where to put this data inside CTWeightCalculations.xlsm:



- Click the **Import** button to continue.
- The information will be transferred from your source spreadsheet to CTWeightCalculations.xlsm.

You can think of it as a refined sub-selection from your source dataset. The spreadsheet at the destination location will only contain columns that you requested in the headers list:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Weight	LCG	TCG	VCG	Min L	Min T	Min V	Max L	Max T	Max V	Stock	Description	Type	
2	152	38775	-7577	7576	38690	-7780	7193	38860	-7430	7793	08-310-000-EM3	Tweendeck Supp	Equipment	
3	54	62855	7659	11750	62705	7600	11528	63005	7765	11993	12-500-000-EM3	Grainblkhd pocki	Equipment	
4	50	22825	8868	3501	22572	8594	3247	23078	8915	3753	09-410-783-BC1	Recessed Anode	Equipment	
5	37	72750	-7866	13804	72685	-8081	13218	72815	-7505	14626	08-100-850-FA1	Cleats, kvaerner	Equipment	
6	8	93787	564	13264	93606	320	13264	93916	940	13364	10-800-000-EN4	Entrance Step, In	Equipment	
7	4	89924	600	485	89889	200	450	89939	1000	500	05-950-000-EE1	Support, L-50x50	Equipment	
8	68	350	8746	12242	80	8625	11972	620	8900	12512	10-600-000-EK6	Porthole Side Blt	Equipment	
9	29	72325	-3780	1432	72025	-4080	1415	72625	-3480	1450	10-500-000-EJ1	Manhole Flush F	Equipment	
10	0	-2849	-9003	6249	-2881	-9006	6203	-2820	-9000	6303	27-300-000-EG2	Steel Number 2,	Equipment	
11	0	53911	715	530	53903	655	462	53919	775	586	05-950-000-EE0	U-Bolt M10, DIN,	Equipment	
12	1	93296	-4778	10574	92611	-5463	10509	93981	-4093	10609	17-210-791-BC1	Counterflange	Equipment	
13	15	11550	-6692	10081	11356	-6967	9993	11744	-6486	10187	17-300-000-NA2	Air Conditioning	Equipment	

- You can repeat the Import operation as many times as necessary while bringing in more datasets and placing them on separate sheets inside CTWeightCalculations.xlsm.

One practical reason for why you may need to import several datasets and store them on separate sheets may be that you are looking to generate different weight curves for Structure, Equipment, Piping and other sections of the ship. You can organize worksheets so that each tab contains parts of one discipline only:

25	76	-328	5542	13071	-1390	5418	12810	707	5568	13300	P
26	2	101421	-3785	10219	101300	-3790	10108	101630	-3780	10280	P
27	2	13304	-4114	7474	13300	-4200	7320	13307	-3960	7560	P
28	16	20736	-1893	11537	20306	-1896	11113	21650	-1890	11716	P
29	178	47211	-3801	1288	47200	-6760	1190	47248	-840	1450	H
30	7	104648	632	13501	104644	29	13454	104652	1235	13554	F
31	3135	86523	8372	9449	81325	7386	8173	91828	8917	10560	P
32	31	94307	-2511	7603	94300	-3750	7540	94330	-1268	7700	H
33	1	15404	4729	4714	15400	4651	4600	15407	4869	4780	P
34	9	21640	-1255	12449	21600	-1260	11722	21700	-1239	13171	H
35	4	98789	21876	3	97892	21657	0	99813	22037	6	M
36	5	94996	1029	3095	94992	738	2975	95000	1260	3175	P
37	2	93596	-3703	7487	93592	-3780	7340	93600	-3580	7570	P
38	5	21705	5040	1530	21700	4490	1500	21710	5590	1561	P
39	179	39709	-8766	5981	39700	-8900	2041	39741	-8680	9920	H

Structure
Pipe
HVAC
Equipment
Sheet1
+

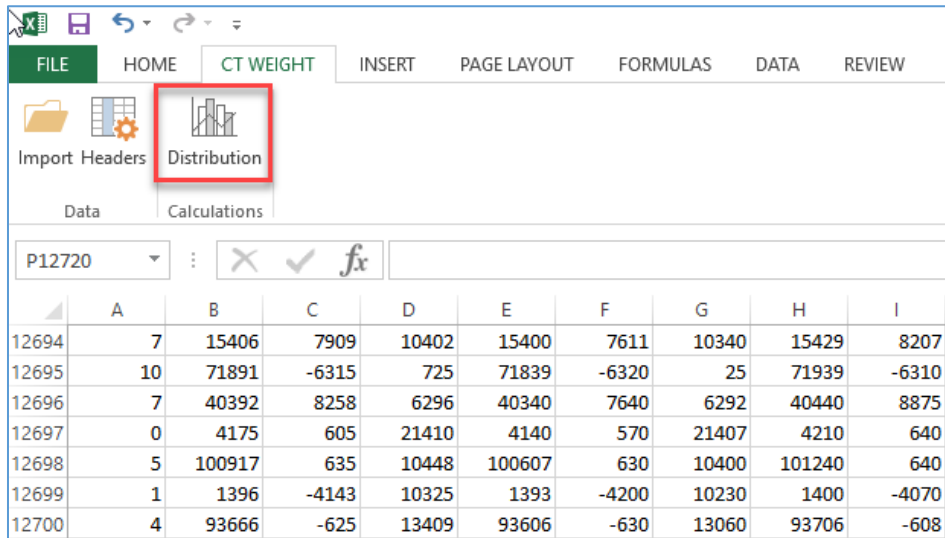
- Overall, there may be many different reasons for working with a few isolated datasets.



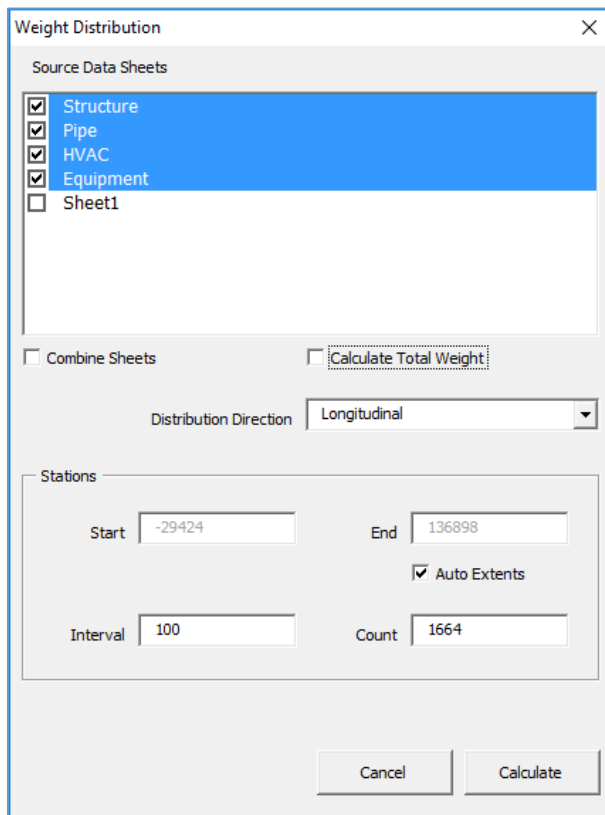
- In some cases, it might be beneficial to add certain sheets manually to CTWeightCalculations.xlsm. For example, you may be looking to enter manual corrections for your weights model to account for parts not represented in ShipConstructor. Or you may be looking to explore various scenarios such as loaded vs. unloaded ship.

When creating sheets manually inside CTWeightCalculations.xlsm, please ensure that you arrange columns in the correct order as specified in the Headers List dialog.

- Once all “refined datasets” are inside CTWeightCalculations.xlsm, click the **Distribution** button located on the ribbon:



- In the **Weight Distribution** dialog, set the desired parameters for the distribution:



The image shows a software dialog box titled "Weight Distribution". It contains several sections for configuring a weight distribution calculation. The "Source Data Sheets" section has a list with checkboxes for "Structure", "Pipe", "HVAC", "Equipment", and "Sheet1", with the first four checked. Below this are checkboxes for "Combine Sheets" and "Calculate Total Weight". The "Distribution Direction" is set to "Longitudinal" in a dropdown menu. The "Stations" section includes input fields for "Start" (-29424), "End" (136898), "Interval" (100), and "Count" (1664), along with a checked "Auto Extents" checkbox. At the bottom are "Cancel" and "Calculate" buttons.

Source Data Sheets	
<input checked="" type="checkbox"/>	Structure
<input checked="" type="checkbox"/>	Pipe
<input checked="" type="checkbox"/>	HVAC
<input checked="" type="checkbox"/>	Equipment
<input type="checkbox"/>	Sheet1

☐ Combine Sheets      ☐ Calculate Total Weight

Distribution Direction: Longitudinal

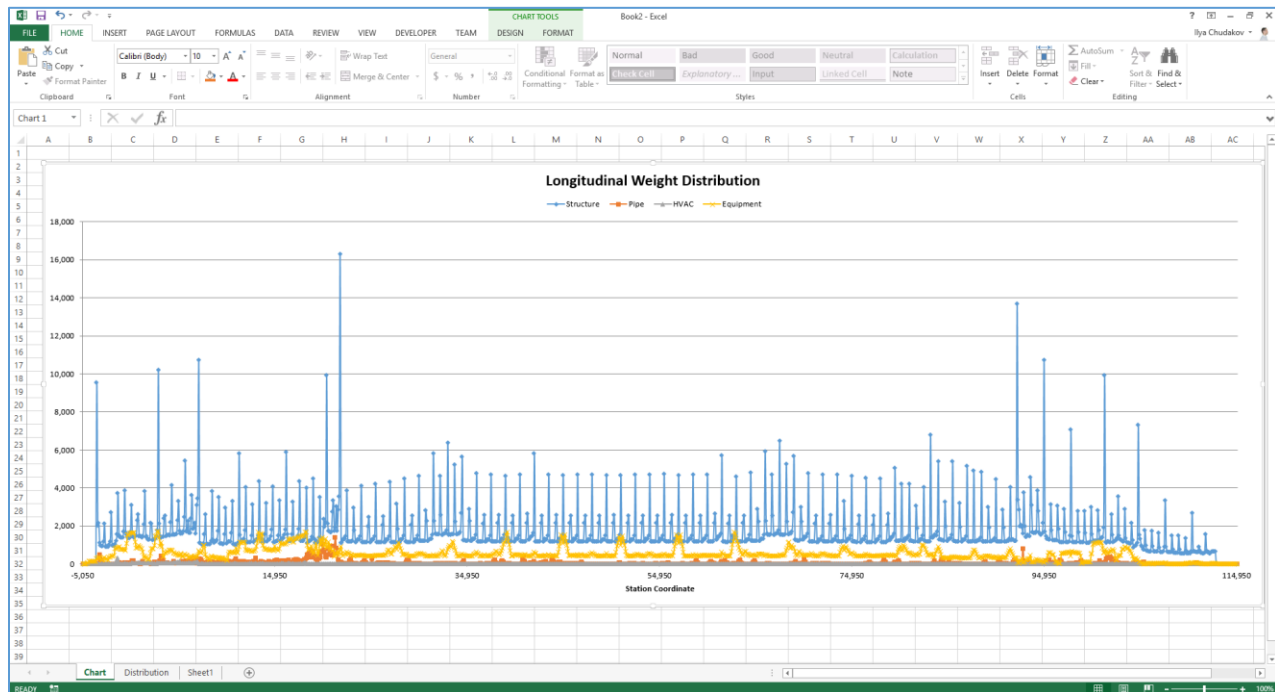
Stations

Start	-29424	End	136898
		<input checked="" type="checkbox"/> Auto Extents	
Interval	100	Count	1664

Cancel      Calculate

Note that you can pick and choose which individual sheets to factor into the calculation. You may choose to combine all tables into one or treat them as separate datasets. There is an option to include an extra column with Total Weight showing the sum of all weights across all datasets. You can change the distribution direction from Longitudinal to Transverse or Vertical. Finally, there is a number of options to assist you with placing station points along the distribution.

- After you click the **Calculate** button, a separate unsaved Excel document will be created showing containing the distribution. The new workbook will have two sheets: one with the chart and one with the underlying data:



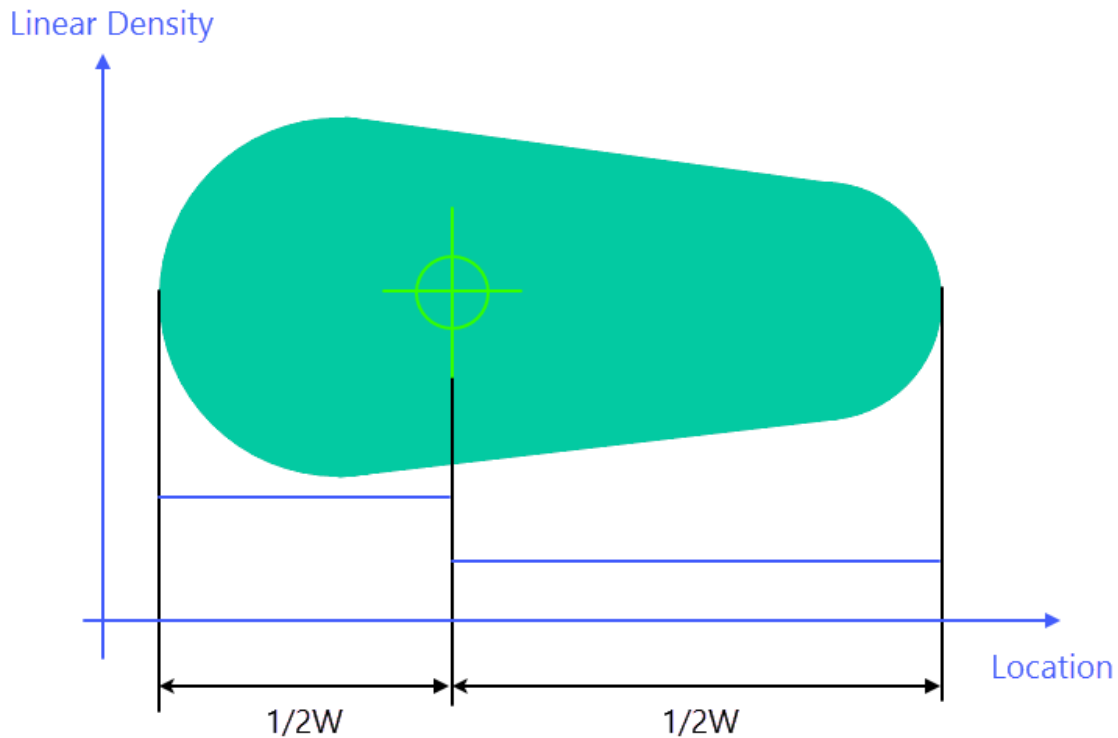
### Method for Calculating Weight Distribution Curves

According to the calculation method used by CTWeightCalculations.xlsm, each weight distribution curve and its associated data represents a linear weight density function along the chosen direction. For each station point, the function tells you the weight for the section of the ship locked in between the current station point and the next one.

The data is presented in absolute units corresponding to the specific length of the interval set between the station points. The figures are not converted into standard units such as tonnes per meter of length. Note that longer intervals will generally result in higher weights per section because the length of each section increases.

It is important to mention that all weight-distribution calculations are not precise. All figures are approximate. For each individual part, the tool is only capable of making its best guess about the weight contribution by a given part at a particular section of the ship. All of the approximations are derived from a very limited information about the part such as its weight, geometric extents and the center of gravity location.

The way the weight density function is calculated for the individual part along the distribution direction is explained in the illustration below:



Each part is subdivided at its center of gravity (CG) into two portions assigned with 50% of weight. Then, the 50% of the weight are averaged for each portion of the part between the closest extent and the CG location. For non-uniform parts with an asymmetric center of gravity, their individual weight density function will appear as a step function as shown by the blue line in the illustration above.

By knowing the linear weight density function for each individual part and the overlap between the part and the current section of the ship, necessary calculations are made to measure the contribution of that part into the section weight.

#### *Ability to Fix Some Parts*

The weight-distribution calculation algorithm has the capacity to fix individual parts with the center of gravity location that is apparently incorrect.

To provide some background on this subject: in ShipConstructor, it is the responsibility of the user to indicate the correct CG location for some part types such as Equipment. Due to the human factor, sometimes, the CG location for Equipment parts may not be specified accurately. There may be other part times similar to equipment in this regard.

If the algorithm identifies a part with the CG lying completely outside of the part's extents, or directly on one of the faces, the algorithm automatically reposition the CG point so that it lies exactly in the middle of the part. The weight of the part will be averaged along its length defined by extents.