



**ShipWeight**

# Weight Engineering Tool for Vessels & Offshore Constructions

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# ShipWeight

- More than 15 years of weight engineering in the ship and oil offshore industry
- ShipWeight:
  - Weight & CG Estimation
  - Weight & CG Tracking
  - Weight & CG Monitoring
  - Weight & CG During Operation
- In use at shipyards, designer firms, and navies all over the world
- Used for a large variety of vessels, including navy vessels (aircraft carriers, submarines, destroyers, etc), offshore vessels (FPSO's, Semi-submersibles, etc) to commercial ships (tankers, cruise and fishing vessels, etc)

The most Powerful Application for Weight Control

ONE SYSTEM FOR ALL TYPES of floating structures

improve future weight estimations

ShipWeight



# ShipWeight – Technical Information

- Windows application running on SQL Server
  - Compatible with SQL Server 2000, 2005 and 2008
  - Running on Windows XP, Vista & 7
  
- Multi-user application
  - Virtually unlimited number of simultaneous users
  - Can handle large amounts data (millions of weight items)
  
- Scalable!
  
- First release in 1995
  - Version 10.0 just released





# Customer Base

- In the US:
  - NNS, Ingalls, BIW, EB, NASSCO, MMC, VT Halter, Austal
  - NAVSEA, USCG, Gibbs & Cox, Alion, CSC
  - Used on aircraft carriers, submarines, destroyers, and more
  - We like to think it is becoming an industry standard for weight control
  
- In Europe:
  - Strong in Scandinavia, especially within offshore.
  - Used on aircraft carriers, tankers, FPSO, offshore vessels
  
- In Asia:
  - In use at major yards and design offices in India, China, Malaysia and Japan



## Weight Estimation is Crucial to a Project's Success

- Weight is the key parameter for determining the amount of steel, workload and time needed in building process
  
- All of these factors are crucial when bidding for a contract;
  - The contract price too high => you lose the order
  - The contract price too low => you lose money
  
- The estimate should indicate how low your bid could be and still make a profit

Weight estimation is crucial in bidding on a contract!



# Weight Control Secures the Project

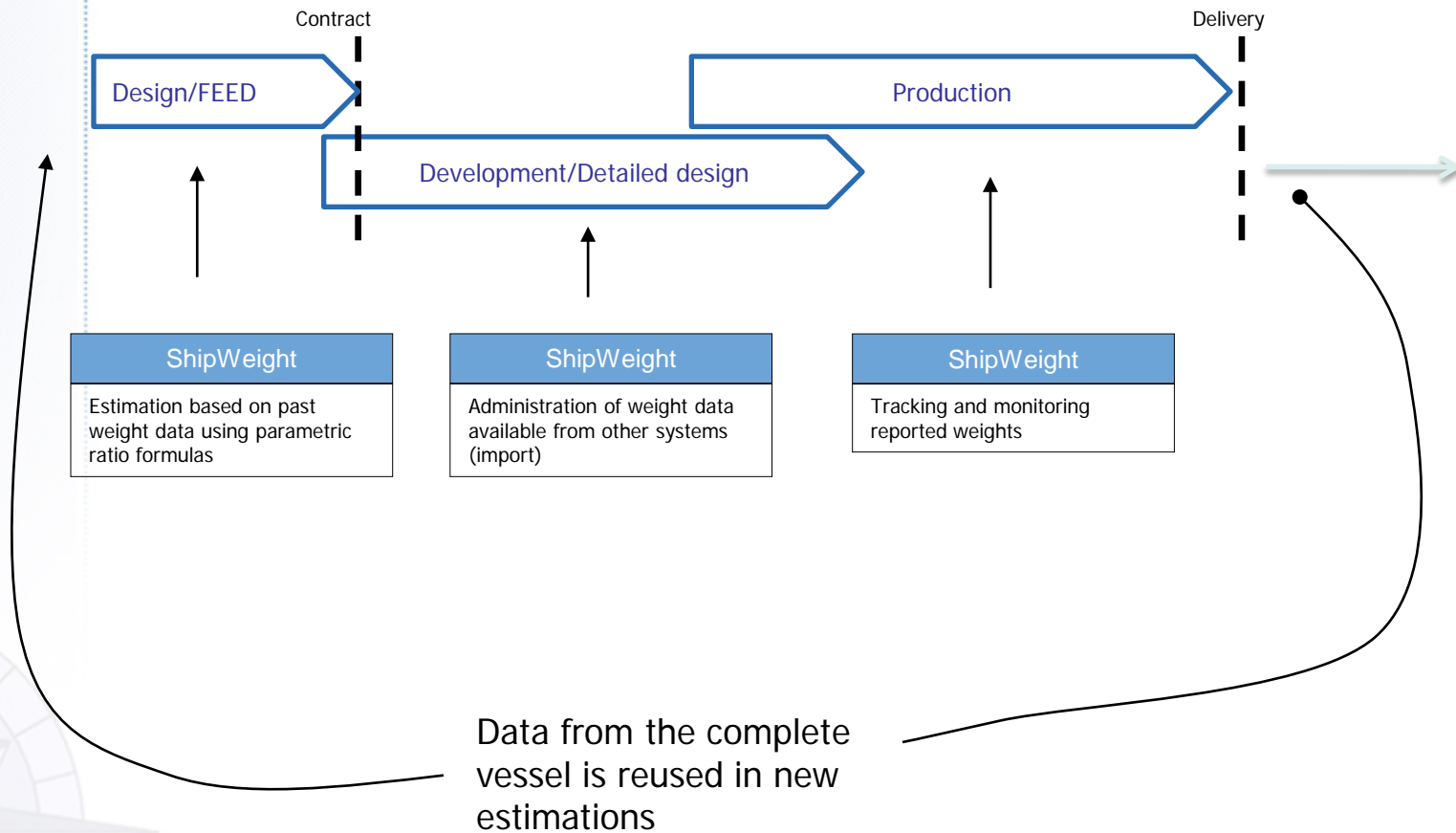
- Fulfill general construction specifications
- Input for operations during construction
- Possibility to make corrective actions during the whole building process
- Documentation (change orders)
- Cost control
- Avoid contract claims
- Complying with ISO Standards (ISO 19901-5)

Weight control makes you able to fulfill the contract!



# One Tool for All Weight Engineering

Reuse and Utilize Your As-built Data !!



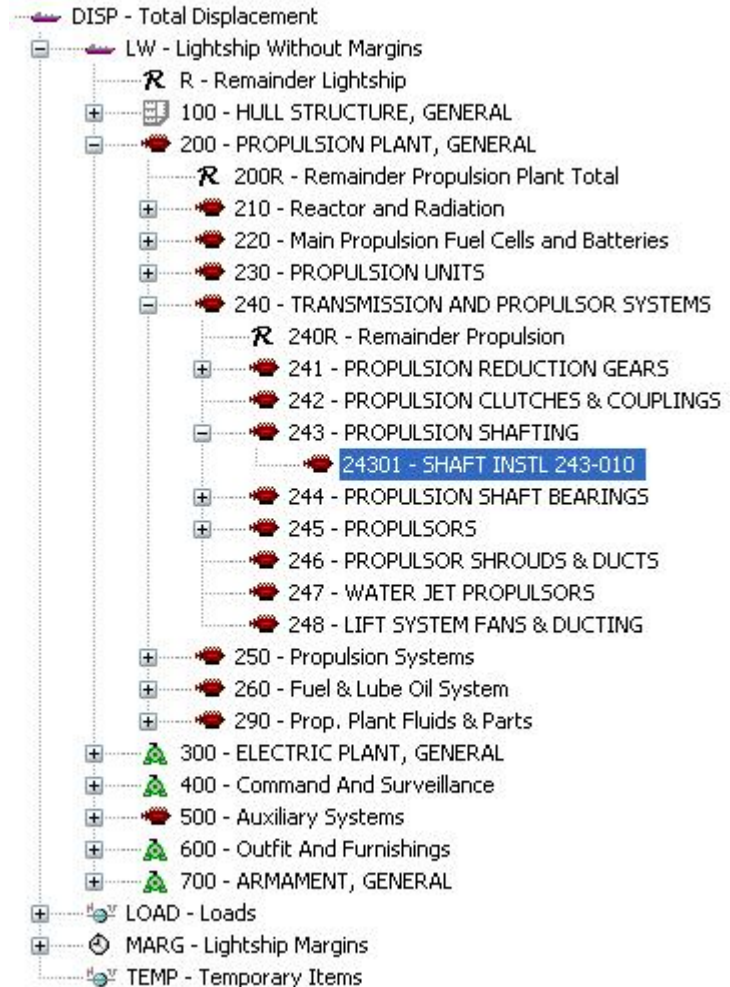


# ShipWeight Functional Capabilities

- Weight & CG Estimation
  - Initial phase parametric estimation
  - Regression on past data
- Weight & CG Tracking/Monitoring
  - Custom fields & input screens defined by the user
- Data Import
  - Text Files, Excel & Access Files
  - Cut, Copy & Paste
  - Import from other software
- Playground Area
  - Check items in & out of the “live” database
  - Track changes and automatically deduct margins
- Reporting
  - Standard reports
  - Crystal Report
- Data Export
  - Text Files
  - Excel, Word & PDF Files
  - Cut, Copy & Paste
  - Export to other software
- Administration & Security
  - Define users and groups with user permissions
  - All actions are logged
- Additional features
  - Weight distribution curve
  - Gyration calculation
  - Visual sanity checking
  - Parent/Child projects
  - System Weight Distribution
  - Loading Conditions & Hydrostatics

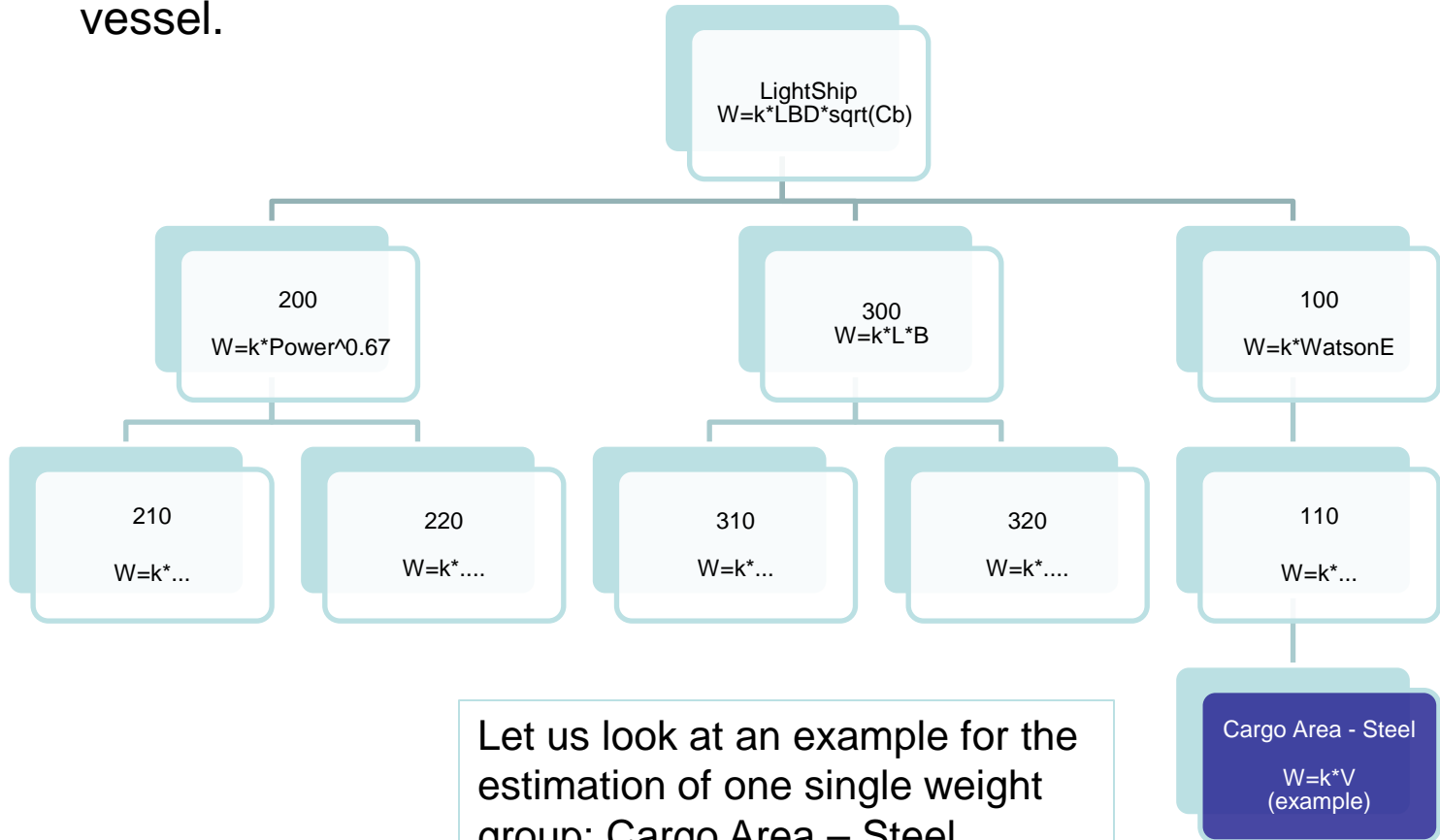
# Work Breakdown Structure

- The construction is divided into a work breakdown structure (WBS) suitable for the user organization, forming a hierarchy of weight groups
- The standard WBS suits most types of constructions
- Can be edited and customized



# Parametric Formulas in WBS

Small sample of weight groups with parametric formulas.  
The sum of groups gives the total weight estimate for the vessel.



Let us look at an example for the estimation of one single weight group: Cargo Area – Steel

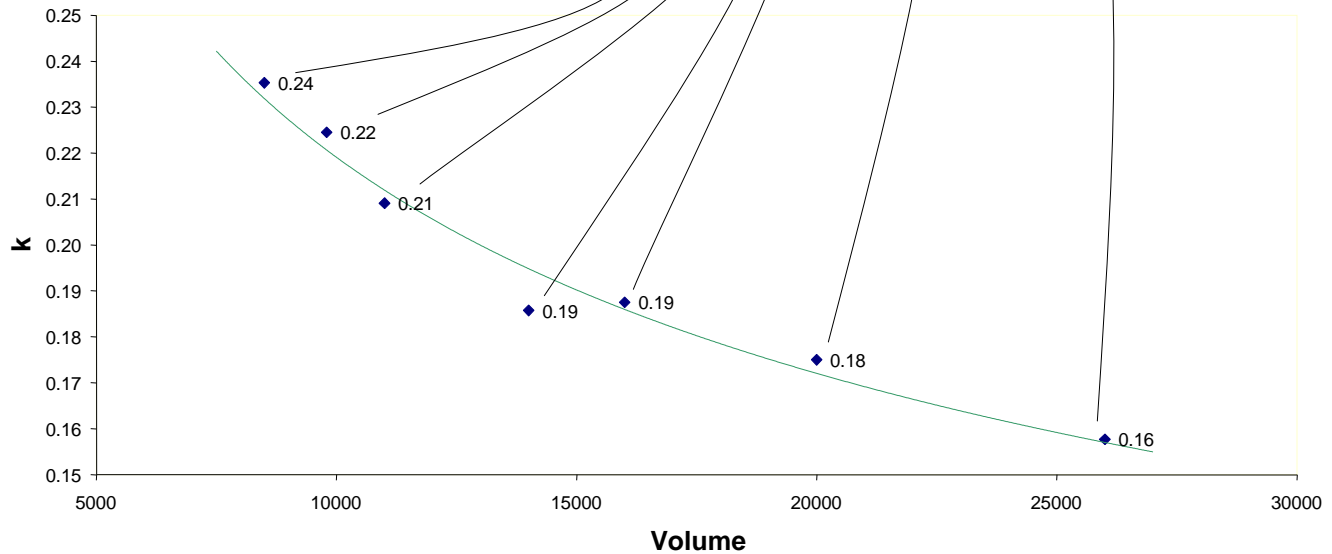
# Regression on Historical Data

Estimation method:  $W = k \cdot V$

Historical Data	Weight [t]	Volume [m3]	k (Weight/Vol.)
Vessel 1	4100	26000	0.16
Vessel 2	3500	20000	0.18
Vessel 3	3000	16000	0.19
Vessel 4	2600	14000	0.19
Vessel 5	2300	11000	0.21
Vessel 6	2200	9800	0.22
Vessel 7	2000	8500	0.24

Data in historical database

Ratio-coefficients calculated and plotted in graph





# Weight Tracking/Monitoring

Items for wgt.grp.: %

Items Edit Setting Tools Window

Setting #1

ID & Description

WgtGrp	ItemNo	Description	RegUser	RegDate
11110	100187	My importe...	Administrator	1/29/2005

Weight & CoG

Factor A	Factor B	Factor C	Factor D	UnitWeight [lb]	Weight [lb]	VCG [ft]	LCG [ft]	TCG [ft]	VCG_min [ft]	VCG_max [ft]	LCG_min [ft]	LCG_max [ft]	TCG_min [ft]	TCG_max [ft]
6	3.000	6.000	3.000	41.000	13284	11	69	17			61	78		

Codes

Source Drawing Number	Source Drawing Number Revision	Reference Drawing Number	Ref Draw #	Category Code	Status	Owner Change Code	INI Change Number Code	Material Code

Accepted Code

Erection Section Code	Station Code	Adjudication Code	Division Code	Owner Furnished Material Code	Trim Cost Code	Ship Code	Source Code	Foundation Note No.

Technology Change Identification Number

Optional

OPM Revision Code	Compartment Code	Hull Identification Code	Data Exchange Code	OPM Accepted Weight Code

Table view

WgtGrp	ItemNo	Description	RegUser	RegDate	Factor A	Factor B	Factor C	Factor D	UnitWeight [lb]	Weight [lb]	VCG [ft]	LCG [ft]	TCG [ft]	VCG_min [ft]	VCG_max [ft]
11110	100187	My importe...	Administrator	1/29/2005	6	3.000	6.000	3.000	41.000	13284	11	69	17		
11110	100576	My importe...	Administrator	1/29/2005	1	2.000	3.000	2.000	14.000	268	19	145	14		
11110	100744	My importe...	Administrator	1/29/2005	5	4.000	5.000	1.000	28.000	2800	10	211	15		
11110	100512	My importe...	Administrator	1/29/2005	5	5.000	2.000	5.000	20.000	5000	9	217	18		
11110	100512a	My importe...	Administrator	1/29/2005	5	5.000	2.000	5.000	9.072	2268	3	66	5	0	
11310	100409	My importe...	Administrator	1/29/2005	3	1.000	2.000	3.000	12.000	216	11	392	12		
11310	100409a	My importe...	Administrator	1/29/2005	3	1.000	2.000	3.000	8.443	98	3	119	4	0	
11310	101038	My importe...	Administrator	1/29/2005	3	3.000	5.000	3.000	47.000	6345	2	114	20		
11310	101038a	My importe...	Administrator	1/29/2005	3	3.000	5.000	3.000	21.219	2878	1	35	6	0	
11510	100766	My importe...	Administrator	1/29/2005	6	1.000	2.000	1.000	55.000	660	5	221	19		
11510	100766a	My importe...	Administrator	1/29/2005	6	1.000	2.000	1.000	24.948	299	2	67	6	0	
11600	100882	My importe...	Administrator	1/29/2005	5	6.000	3.000	5.000	25.000	11250	4	112	8		
11600	100882a	My importe...	Administrator	1/29/2005	5	6.000	3.000	5.000	11.340	5103	1	4	2	0	
11630	100305	My importe...	Administrator	1/29/2005	5	3.000	4.000	6.000	46.000	36560	3	296	4		

Total weight & CoG

Weight [lb]	Weight [t]	VCG [ft]	LCG [ft]	TCG [ft]	VCG_min [ft]	VCG_max [ft]	LCG_min [ft]	LCG_max [ft]	TCG_min [ft]	TCG_max [ft]
5692333.000	2541.220	11.097	247.414	10.125	0.000	10.000	-6.030	511.740	0.000	0.000

- Combined single record- and table view
- User-customized setup of input view
- Up to 100 user-defined fields
  - Maturity & Contingency
  - Modules & Sections
  - Allowance
  - Fluids
  - Department & Disciplines
- Sorting and filtering capability
- Multiple modification of items
- Windows Cut, Copy and Paste



# Data File Import (Generic)

ShipWeight Data File Import

Import source Options

Data file to import: C:\Temp\sddtop input runar.xls Browse...

File type

No delimiter  Excel file Worksheet: Sheet1  Custom delimiter: . 2nd:

Tab delimiter  Access file Table: TABLE1

New definition Open definition... Save Save as...

From Column	To Column	Database Field	Indicator	Decimals	Field Title
-	-	WgtGrp	-	-	WgtGrp
-	-	ItemNo	-	-	ItemNo
-	-	Description	-	-	Description
-	-	NoOff	-	-	NoOff
-	-	UnitWeight	-	-	UnitWeight
-	-	VCG	-	-	VCG
-	-	LCG	-	-	LCG
-	-	TCG	-	-	TCG
-	-	C29	-	-	- not defined -
-	-	C02	-	-	Company
-	-	C03	-	-	Discipline
-	-	C10	-	-	Accuracy
-	-	C12	-	-	Allowance
-	-	C30	-	-	- not defined -
-	-	C08	-	-	LSW
-	-	C04	-	-	Area
-	-	C26	-	-	- not defined -
-	-	C01	-	-	Remark

Advanced >>>

Edit definition of selected line

Link columns from 1 to 999 to field

Number of decimals: 3 Add Edit Delete

Start import Close

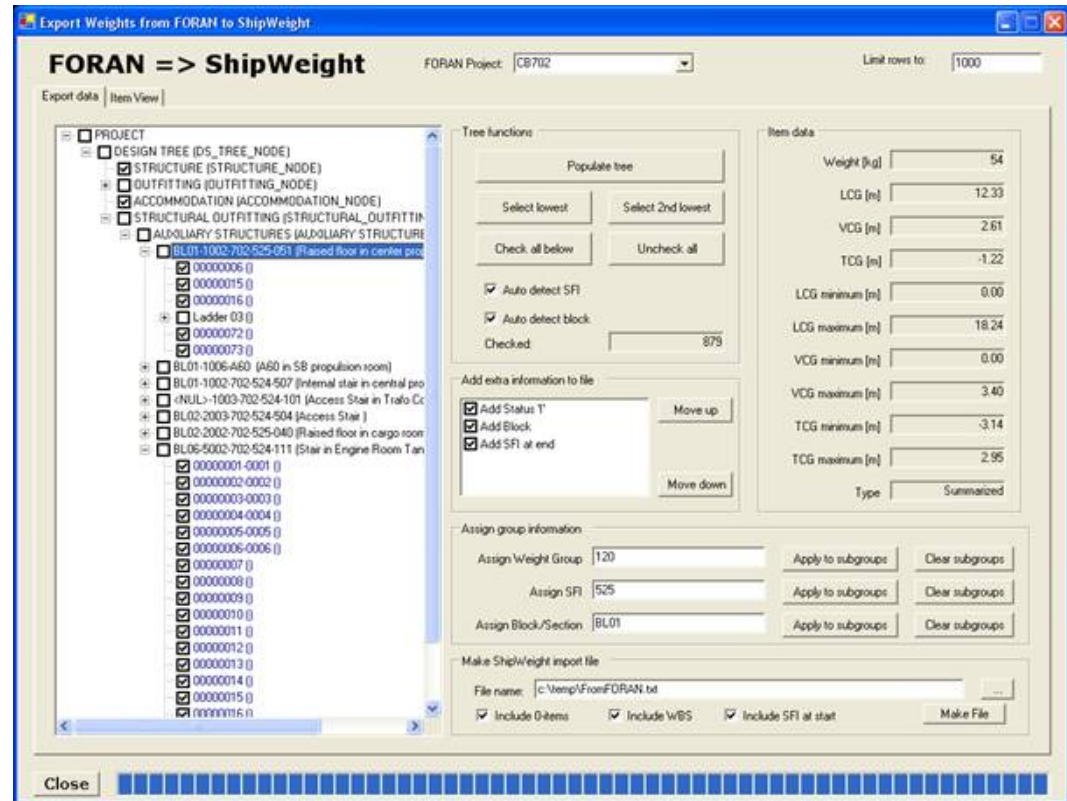
➤ The following formats can be imported in a generic way defined by the user:

- Flat text files
- Delimited text files
  - Tab-delimited
  - Comma delimited
  - Etc...
- MS Excel files
- MS Access files



# Specialized Imports

- Direct access to the CAD system and the weight information in the CAD model
- Quality check prior to input
- Grouping of items
- Extracting additional information





# ShipWeight Main Window

ShipWeight 10.01 [TstSystDistr[ImportTest]] - ShipWeight Enterprise

Project Edit View Database Weight Groups Items Checking Std.dev. Estimate Help

TstSystDistr (ImportTest) BAS Anchor

Weight Groups

Weight Groups	Weight	Std.	V...	Std...	LC...	Std...	T...	Std...	Lower ...	Upper ...	Alt [#]	Fore [#]	PS [m]	SB [m]
DSP - Displacement	3 466	0.00	6.85	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
DR - Remainder displacement														
DW - Deadweight														
LW - Lightship	3 466	0.00	6.85	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
R - Remainder														
T - Topside														
M - Machinery	433	0.00	6.44	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
MR - Remainder machinery														
M1 - Machinery main-components	358	0.00	6.48	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M1.1 - Diesel-engine for prop.	220	0.00	6.76	0.00	#4...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M1.2 - Steam-engine for prop.														
M1.3 - Other engine for prop.														
M1.4 - Gear system	55	0.00	6.03	0.00	#4...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M1.5 - Propel system	52	0.00	6.30	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M1.6 - Fast vessel prop. syst.														
M1.7 - Foil, sail, rig & mast														
M1.8 - Boilers, steam & gas gen.														
M1.9 - Aggr. & gen. el.prod.	31	0.00	5.56	0.00	#1...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M2 - Machinery system	76	0.00	6.29	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M2.R - Remainder machinery system														
M2.1 - Fuel systems	7	0.00	6.47	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M2.2 - Lube oil systems	7	0.00	6.59	0.00	#1...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M2.3 - Cooling system	22	0.00	6.00	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M2.3.R - Remainder cooling system														
M2.3.1 - Sea water cooling system														
M2.3.2 - Fresh water cooling system														
M2.4 - Compressed air systems	2	0.00	5.17	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M2.5 - Exh. syst. & air intake	10	0.00	5.44	0.00	#4...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0
M2.6 - Steam, cond. & feed water														
M2.7 - Dist. & make-up water sys	2	0.00	8.65	0.00	#3...	0.00	0.00	0.00	0	0	#0.00	#0.00	0	0

Items

Items	Description	Weight[t]	VCG [m]	LCG [#]	TCG [m]	VCG_min [m]	VCG_max [m]	LCG_min [#]	LCG_max [#]	TCG_min [m]	TCG_max [m]
00001	Exh. syst. & ai...	6.716	5.099	#48.78	0.000	0.000	0.000	0.000	0.000	0.000	0.000
00002	Exh. syst. & ai...	2.878	6.220	#50.17	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>Total</b>		<b>9.595</b>	<b>5.435</b>	<b>49.197</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>

Project Info

ID AND REG.INFO  
 Database ID TstSystDistr  
 Project ID ImportTest  
 Parent ID  
 Registration Person slon  
 Registration Date 23.1.07  
 NAME, OWNER AND T...  
 Vessel Name BAS Anchor  
 Vessel Owner BAS engineering  
 Main Vessel Type Offshore Vessel  
 Vessel Type Anchor Handling Tug  
 DRAWINGS  
 Graphics File  
 DXF File  
 DESIGN AND YARD  
 Ship Designer  
 Design  
 Ship Yard

Parameters

MAIN PARAMETERS

MAIN DIMENSIONS

Ship length over ... 80.00  
 Length betw. per... 70.00  
 Ship breadth [m] 18.00  
 Depth upperm. c... 8.00  
 Depth to mainde... 8.00  
 Draught, CIL [m] 6.50  
 Scantling draugh... 6.50  
 Displacement [t] 6 296

CAPACITIES

Numb. passage... 50  
 Numb. crew [t] 0  
 Numb. cars [t]  
 Numb. container...

TONNAGE

Gross tonnage [t] 50  
 Net tonnage [t] 2 500  
 Deadweight [t]

Codes

CD1 - Section code 0.000  
 CD2 - Area code 0.000  
 CD3 - Module code 0.000  
 CD4 - Function code 0.000  
 \* 0.000  
 2 - Hull 0.000  
 20 - Hull Materials, Ge... 0.000  
 201 - Hull Materials 0.000  
 202 - Transporta... 0.000  
 203 - Blasting, S... 0.000  
 204 - Testing Of ... 0.000  
 205 - X-ray & UT... 0.000  
 206 - Template S... 0.000  
 207 - Joining Of ... 0.000

For Help, press F1

NUM

➤ Runtime summation of all key values for all levels of the work breakdown structure (weight groups)

# Playground Area

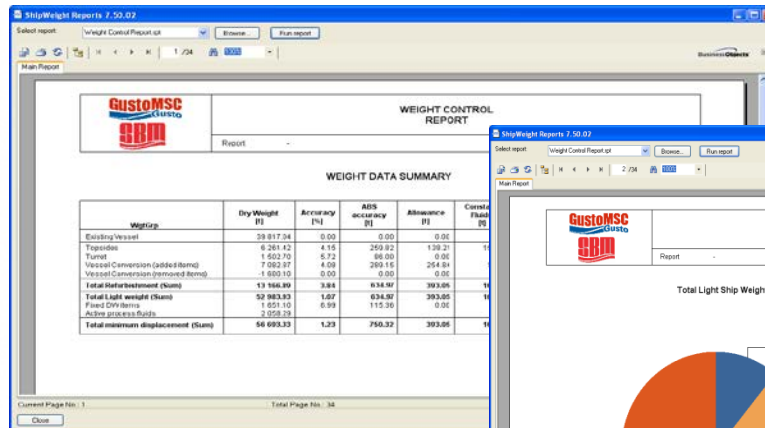


- ShipWeight "Playground Area" is a workspace where you can enter and edit weight data outside the main project data
- Weight data is checked in and out of the "Playground Area" and this operation is logged along with change summaries
- The purpose of the "Playground Area" is
  - To be able to check changes to the database before it goes "live"
  - To track changes to the database better
  - To handle margins better

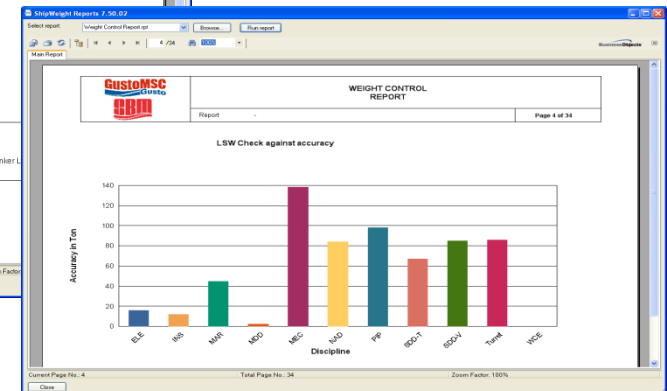
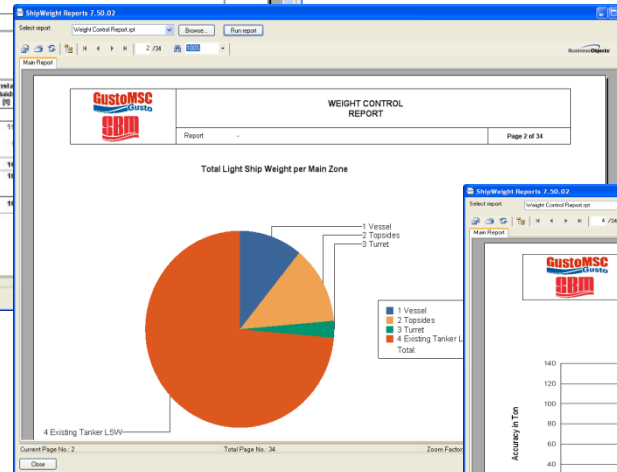


# Reporting

- Crystal Reports combined with ShipWeight custom codes makes it easy to report at various levels of coordinates and coded subgrouping
- Export to text file, Excel, Word & PDF format
- Group, summarize and display graphs for the quantities you want

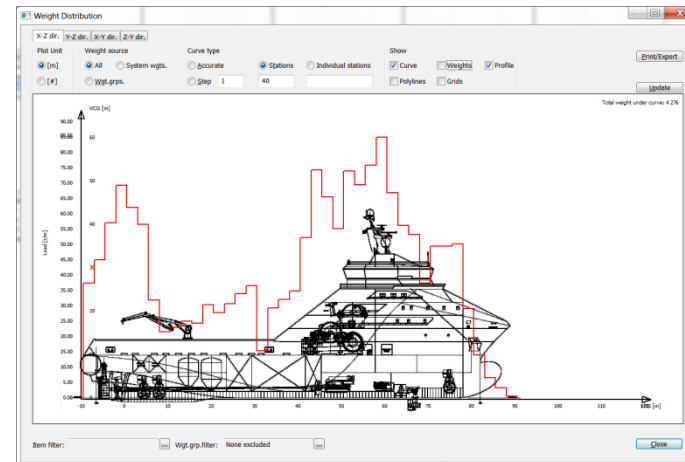
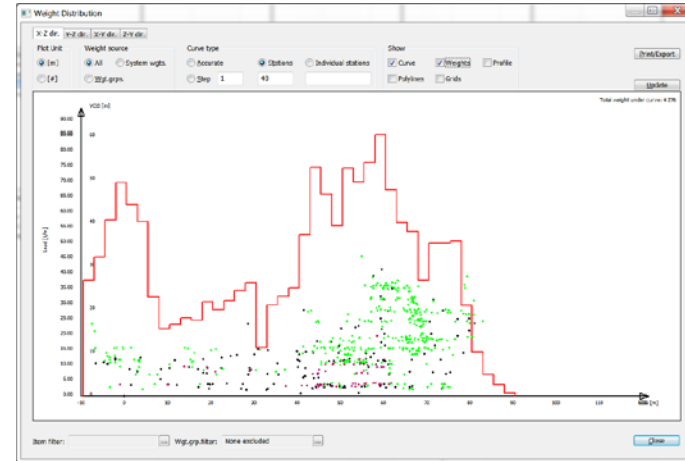


## Sample report



# Weight Distribution Curve

- To obtain the weight distribution curve, fore and aft values must have been entered for the weight items
- The curve can be exported to several different file formats readable for stability programs



# Moment of Inertia & Gyradius

- Moment of Inertia are calculated using Steiner's theorem
- Inertia around the single weight item is calculated approximating the item to a box
- Gyradius values for input to seakeeping analysis calculated for
  - Roll
  - Pitch
  - Yaw
  - Pitch/Yaw
  - Roll/Yaw

Gyradius Calculations

Filter  
Item

Wgt.grp.filter:  
None excluded

Self inertia (2.term)  
 Includ  Predef.v  Calc. if not define  
 x-axis:   
 y-axis:   
 z-axis:

Variable	Value	Type	Inertia (I) [tm <sup>2</sup> ]	Gyradius (K) [m]	K/Lpp	K/B
Weight [t]:	4 275.590	Roll (xx)	171 518.40	6.33	0.333	
VCG [m]:	9.250	Pitch (yy)	3 181 642.23	27.28	0.379	
LCG [m]:	39.377	Yaw (zz)	3 067 127.34	26.78	0.372	
TCG [m]:	-0.722	Pitch/Yaw (yz)	-3 932.28	0.96	0.050	
Length p.p. [m]:	72.00	Roll/Yaw (xz)	-210 264.74	7.01	0.379	

WgtGrp - Ite...	Description	Weight	VCG	LCG	TCG	Ixx	Iyy	Izz	Iyz
C - 001	Test	4.000	0.000	0.000	0.000	344	6 545	6 204	-27
TR - 00576	Back up SW ...	0.220	4.100	44.000	-2.500	7	12	7	2
TR - 00577	Bulk c. cool c...	0.050	3.900	8.500	-0.400	1	49	48	-0
TR - 00578	Central coole...	1.630	4.600	42.000	-2.900	43	62	34	17
TR - 00579	Central coole...	1.580	4.600	41.800	1.800	44	59	35	-19
TR - 00580	FW cooler au...	0.100	4.200	41.500	-1.800	3	4	1	1
TR - 00581	FW cooling p...	0.070	4.200	45.000	1.500	2	5	3	-1
TR - 00582	FW expansio...	0.190	10.200	42.100	-6.100	6	3	8	-1
TR - 00583	FW expansio...	0.190	10.300	40.100	-5.100	4	1	5	-1
M1.1 - 00535	Main Engine ...	0.040	2.900	53.000	-0.900	2	9	8	0
M1.1 - 00536	Main engine ...	2.760	2.900	53.600	-1.900	115	678	570	21
M1.1 - 00537	HFO module ...	0.140	7.300	51.000	-9.500	11	19	30	2
M1.1 - 00538	HFO module ...	99.510	7.300	46.700	-7.300	4 684	7 116	11 043	1 276
M1.1 - 00539	FW preheate...	0.010	7.500	55.400	-5.400	0	3	3	0
M1.1 - 00540	Hjelpemotor	22.010	6.000	45.200	0.000	244	1 173	952	-52

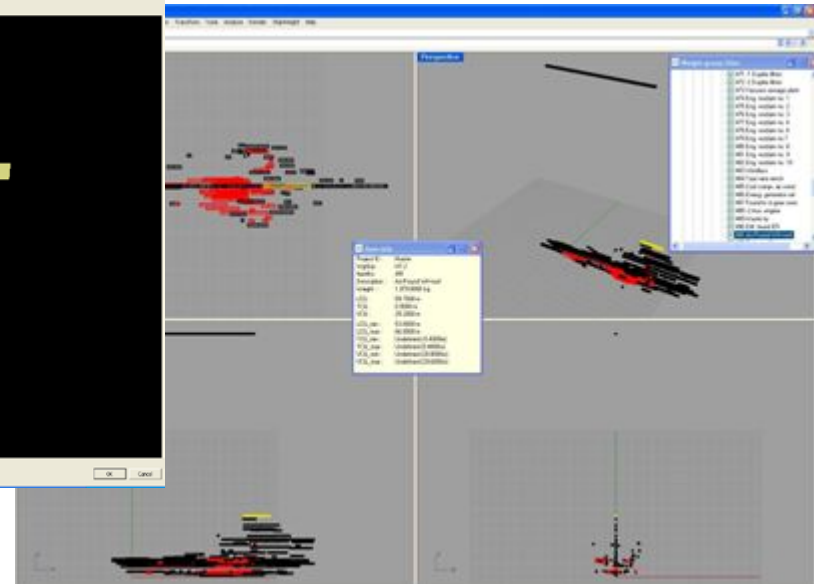
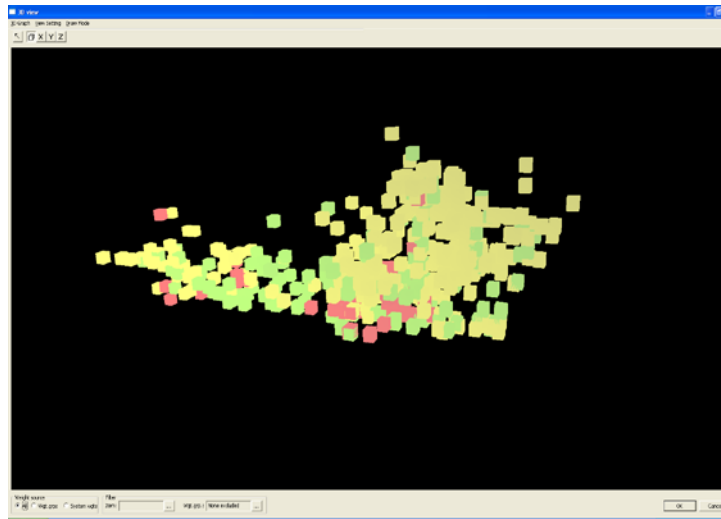
Print OK Cancel





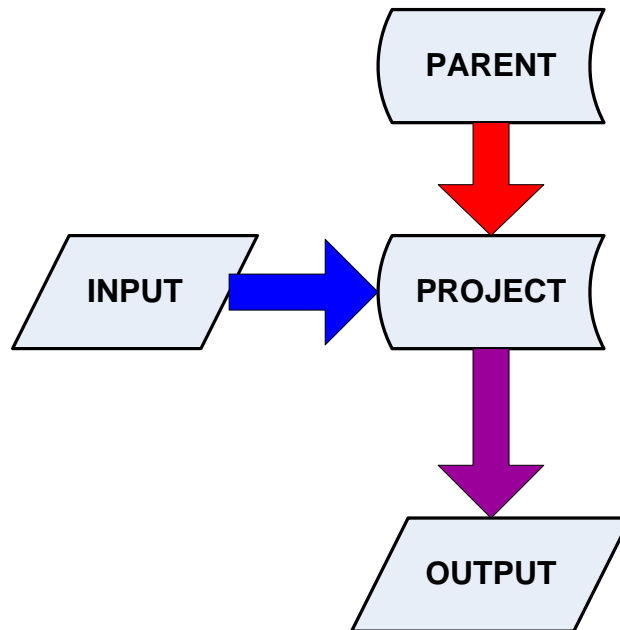
# 3D Visualization

- Open GL graphics for visual sanity checking
- Rhino Plug-in
  - Displaying mass items in 3D
  - Displaying properties for selected items
  - Filter and options by WBS
  - Read directly from the ShipWeight SQL database



# Parent/Child Project Functionality

## ➤ Dataflow:



## Utilities:

### Loading conditions

- Parent project is lightship
- Project contains loads

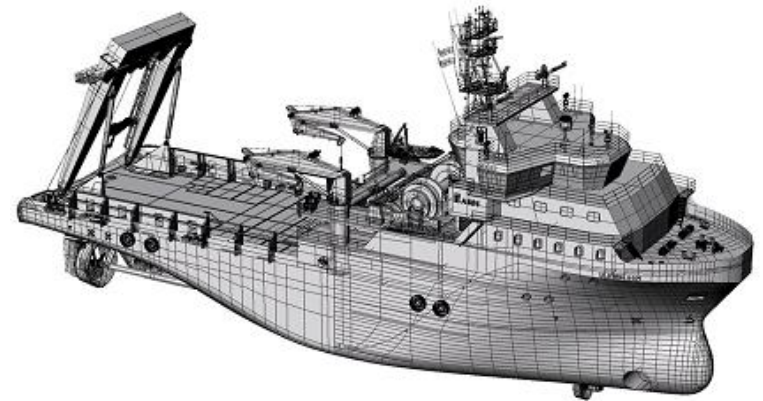
### Base class projects

- Parent project is base class
- Project contains deviations to base class



# Summarizing ShipWeight strengths

- Combine the structure of a database with the calculation power of a spreadsheet
- Make structuring and reuse of weight data as easy as possible
- Same system for weight estimation and weight tracking
- The user is always in control
- Consistency in historical data



*Flexibility to be used on a macroscopic as well as a microscopic level*

# Ideas for Future Development

- Regression on other ship design parameters than weight (conceptual design tool – feasibility study)
  - Main Parameters
  - Volumes & Areas
  - Layout tool
- Estimation of Cost
  - Material Cost
  - Labour Hours
- Links to other tools
  - Weight Legacy Data Tools
  - 3D CAD (ShipConstructor, NX Siemens, ...)
  - Purchasing systems, Q&A, progress & scheduling tools



# Information Sources

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For more information, please visit us at

[www.shipweight.com](http://www.shipweight.com)

