



BUREAU
VERITAS



LoadSafe

Loading calculator software

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1. General features

For a given ship LoadSafe calculates intact stability, longitudinal strength and, optionally, damage stability.

User may perform test or real calculation. He can manage ship loading history according to his own management criteria.

Software organisation is client/server type, thus insuring a complete protection of core data and server-side coherence check on inputs. It works under any Windows™ 32 bits operating system (Win9x, WinNT, WinMe, Win2k, WinXP)

Upon request, software may be adapted to on-line gauging system.

Software interface is both ergonomic and flexible, taking advantage of all Windows features. User may change part of the interface to adapt to its needs.

Software comes with complete user documentation (both on paper and electronic) and on-line help.

Demonstration version is available upon request.

2. Technical Description

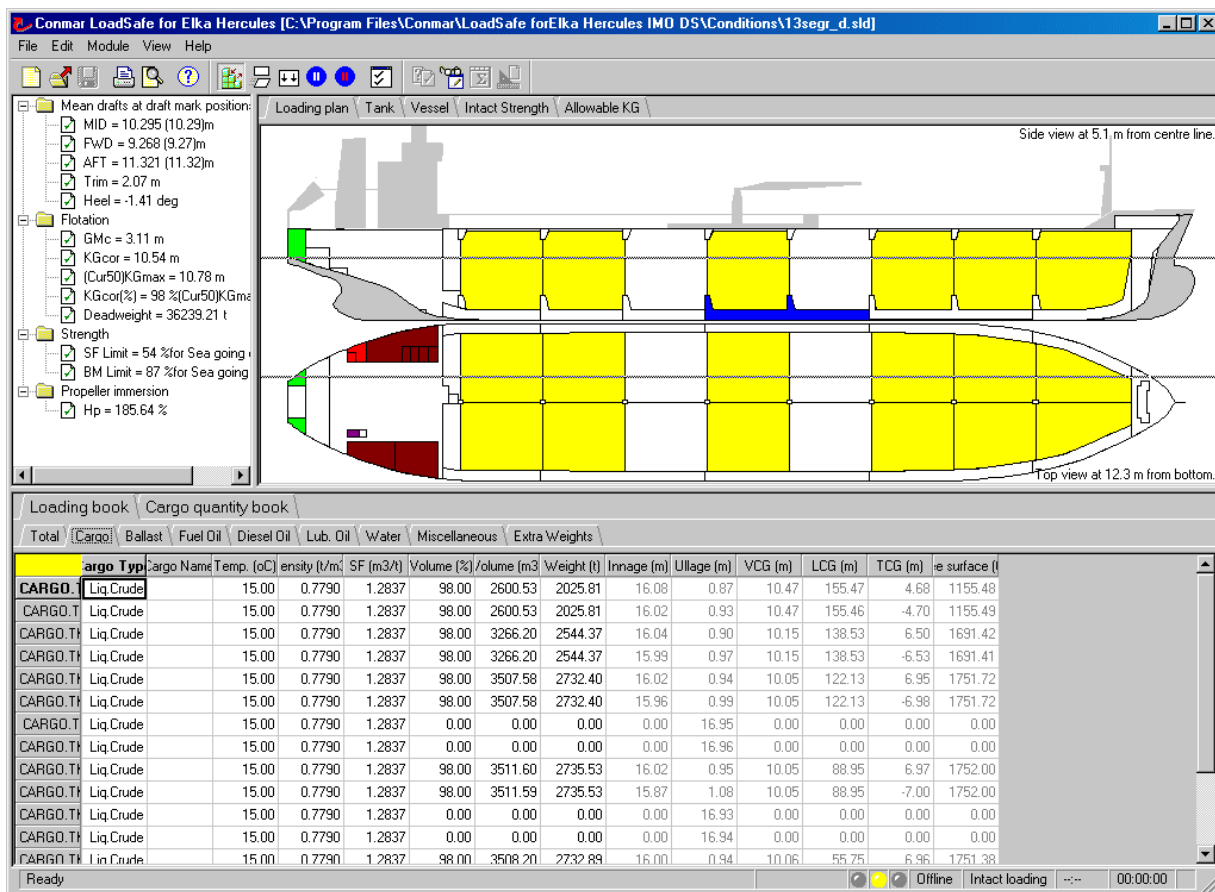
1. Program Specification

The program is written in C++. Class encapsulation mechanism of C++ provides integration of functions with relevant data. This guaranties that correct data are assigned to functions that operate on it. As a result the calculations are very safe and particular data structures together with calculation methods can be altered without many interventions to code. Also, communication between user interface and calculation is made client-server, so changes in anyone element don't imply changes in other one.

2. Displacement Calculation

The basic principle of the displacement calculation is direct calculation in 3-d mathematics. It means that all ship's hydrostatics are being calculated including actual trim and list as result of real ship's flotation. For this purpose the actual hull data are created on the basis of the information derived from offset table, body plan, capacity plan and structural drawings.

Ship flotation as result of the static equilibrium is based on iteration process (optimization method). During iteration process actual centre of gravity position due to free liquid in tanks is being calculated. Results of these calculations are six draught at draught marks, displacement, trim, list, initial metacentric height, corrected metacentric height and centre of flotation.



3. Weight Calculation

Geometry of each compartment has been previously specified and is contained in the program by the series of the 3D contour points.

Weight calculation is based on direct volume calculation of the compartment space occupied by the corresponding content.

Liquid

Direct calculation of the Volume and its actual Centre of Gravity is being performed on the level or ullage specification basis, including free liquid effect defined by angles of heel and trim in accordance with tank geometry. This method provides calculation of real quantity of liquid when the vessel is heeled and trimmed to each of the heeling or trimming angles.

For oil products, the volume characteristics are recalculated according to the temperature changes in relation to the standard cargo temperature.

Bulk and Grain

The Volume, LCG, TCG and VCG values are directly calculated on the level of filling with vessel's even keel and no heel assumptions basis. For grain at each of loading level additional moments of grain shifts are calculated according to IMO recommendations and procedures. The grain moments for trimmed and untrimmed ends are previously entered in program from ship's documentation.

Solid

General cargo, timber, containers, vehicles and other solid cargo can be also specified as unit of prismatic form by means of special program functions. In that case unit's centre of gravity is automatically calculated. Geometrical description of the net available space (excluding internal structures) within cargo holds provide proper solid cargo stowage.

Extra weights

Various load which may not be assigned a pre-defined location may be entered as extra weight. User weight and position of centre of gravity for each extra weight.

4. Missing deadweight calculation

Too often, the master does not have all necessary data to prepare an accurate loading condition, as some equipment are put on board or removed either without information to master or with uncertain weight and position estimate.

The "Missing Deadweight" calculation process is a way to solve this problem as it is better to have an estimate than to perform an accurate calculation on inaccurate loading condition data.

From observed draughts, software calculates actual displacement together with longitudinal and transverse position of ship centre of gravity. Then it deducts from these data and current loading condition the missing deadweight value together with longitudinal position of corresponding centre of gravity. The result is displayed to user which may insert his own estimate of VCG

This weight may then be inserted in loading condition as an "Extra weight".

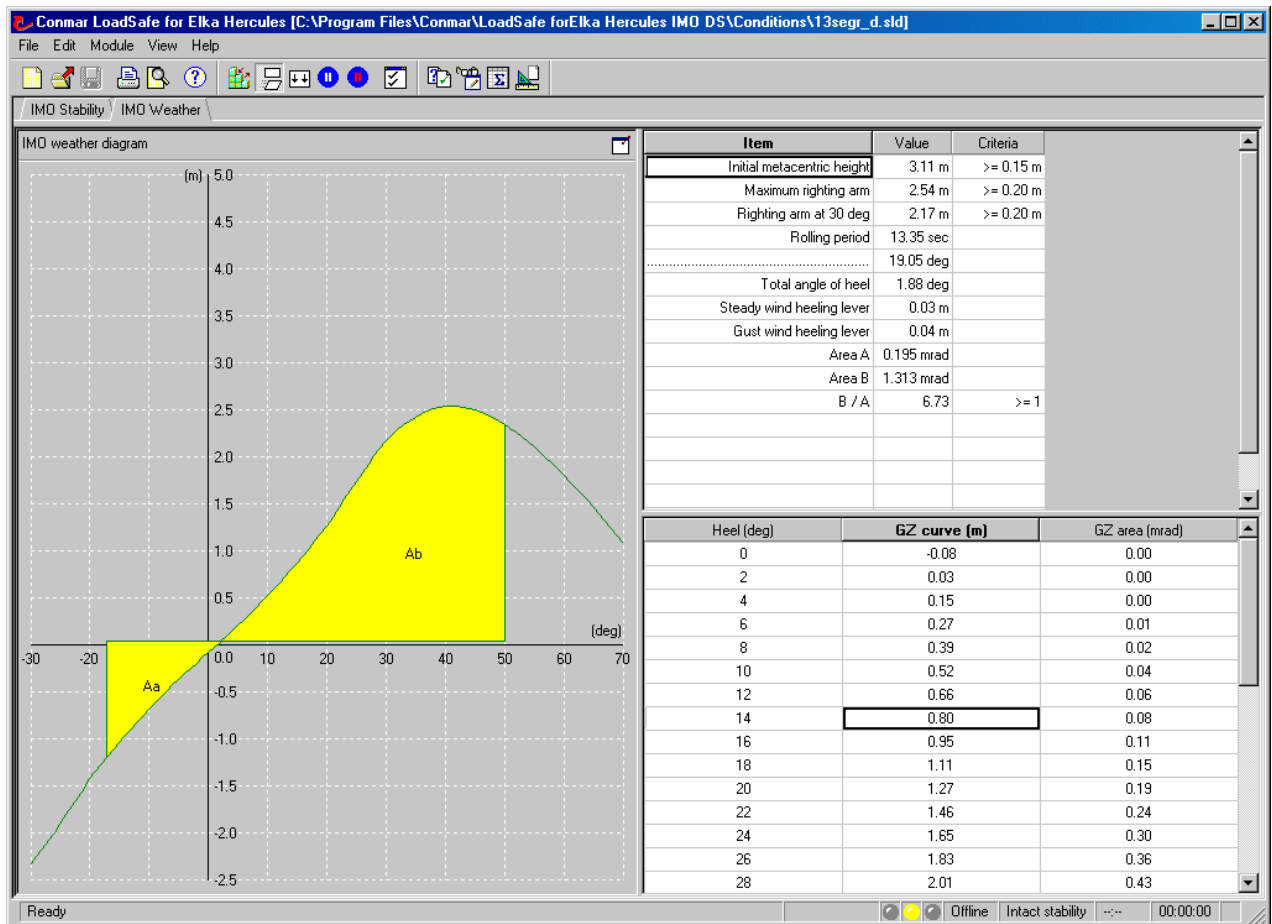
5. Stability Calculation

Intact Condition

Intact stability method of calculation for actual flotation regarding loading condition is direct calculation of the centre of buoyancy position at different angles of heel as a 0, 2, 5, 10, 15, 20, 30, 40, 50, 60 and 70 deg at constant displacement and free trim. Centre of gravity position is being calculated with and without free liquid effect corresponding trim and angle of heel. Initial trim is a trim at angle of heel equal zero. Righting levers are obtained as result of perpendicular distance between centre of gravity and direction of the action of the force of buoyancy. All intermediate righting lever values are obtained by interpolation.

Calculation of wind heeling lever is also direct calculation of the projected lateral area for the actual draught and trim.

Results of these calculations are righting levers with and without free liquid effect and all necessary data for IMO intact stability and weather criteria checking .



Damage Condition

Any compartment of any compartment group including void space may be damaged and flooded according to user specification. For the static equilibrium of the damaged ship and damage stability procedure "lost buoyancy" method is used. Calculation of the final waterline after flooding is based on iteration process (optimisation method) of level equation between the level in flooded compartment and corresponding waterline as result of the static equilibrium. In each individual step of iteration process actual buoyancy is reduced for the flooded water volume (lost buoyancy). Iteration process is completed when the difference between the level in flooded compartment and corresponding waterline is less than 0.02 m. Damage stability free trim procedure is based on the same principles.

This method provides calculation of an intermediate stage of flooding taking into account free liquid effect of the flooded water and all partially filled tanks. Direct calculation of free liquid effect is applied as previously explained.

Procedure for damage stability calculation is done in same way as described in intact stability calculation.

Results of this calculations are six draughts at draught marks, trim and heel as result of the selected flooding stage and all necessary data for IMO/MARPOL damage stability and weather criteria checking.

Conmar LoadSafe for Elka Hercules [C:\Program Files\Conmar\LoadSafe forElka Hercules IMO DS\Conditions\13segr_d.sld]

File Edit Module View Help

Continue IMO Scenario

	IMO Status	T-AFT	T-MID	T-FWD	Trim	Heel	To Deck	To Op
		[m]	[m]	[m]	[m]	[deg]	[m]	[m]
SIDE DAMAGE No 1	YES	11.10	10.57	10.04	1.07	6.31	5.50	6.
SIDE DAMAGE No 2	YES	10.95	11.24	11.52	-0.57	13.95	2.61	4.
SIDE DAMAGE No 3	YES	12.57	11.09	9.62	2.98	12.93	2.78	3.
SIDE DAMAGE No 4	YES	12.07	10.64	9.21	2.89	8.25	4.31	5.
SIDE DAMAGE No 5	YES	12.23	10.53	8.82	3.45	1.75	5.57	6.
BOTTOM RANKING No 6	YES	10.10	11.17	12.24	-2.15	11.95	3.14	5.
BOTTOM RANKING No 7	YES	9.46	11.86	14.25	-4.84	0.15	5.63	7.
BOTTOM DAMAGE No 8	YES	11.05	10.75	10.44	0.61	1.53	6.73	7.
BOTTOM DAMAGE No 9	YES	12.44	10.81	9.17	3.30	1.79	5.35	6.

Side view at 5.1 m from centre line.

Top view at 12.3 m from bottom.

IMO Scenario - BOTTOM DAMAGE No 9

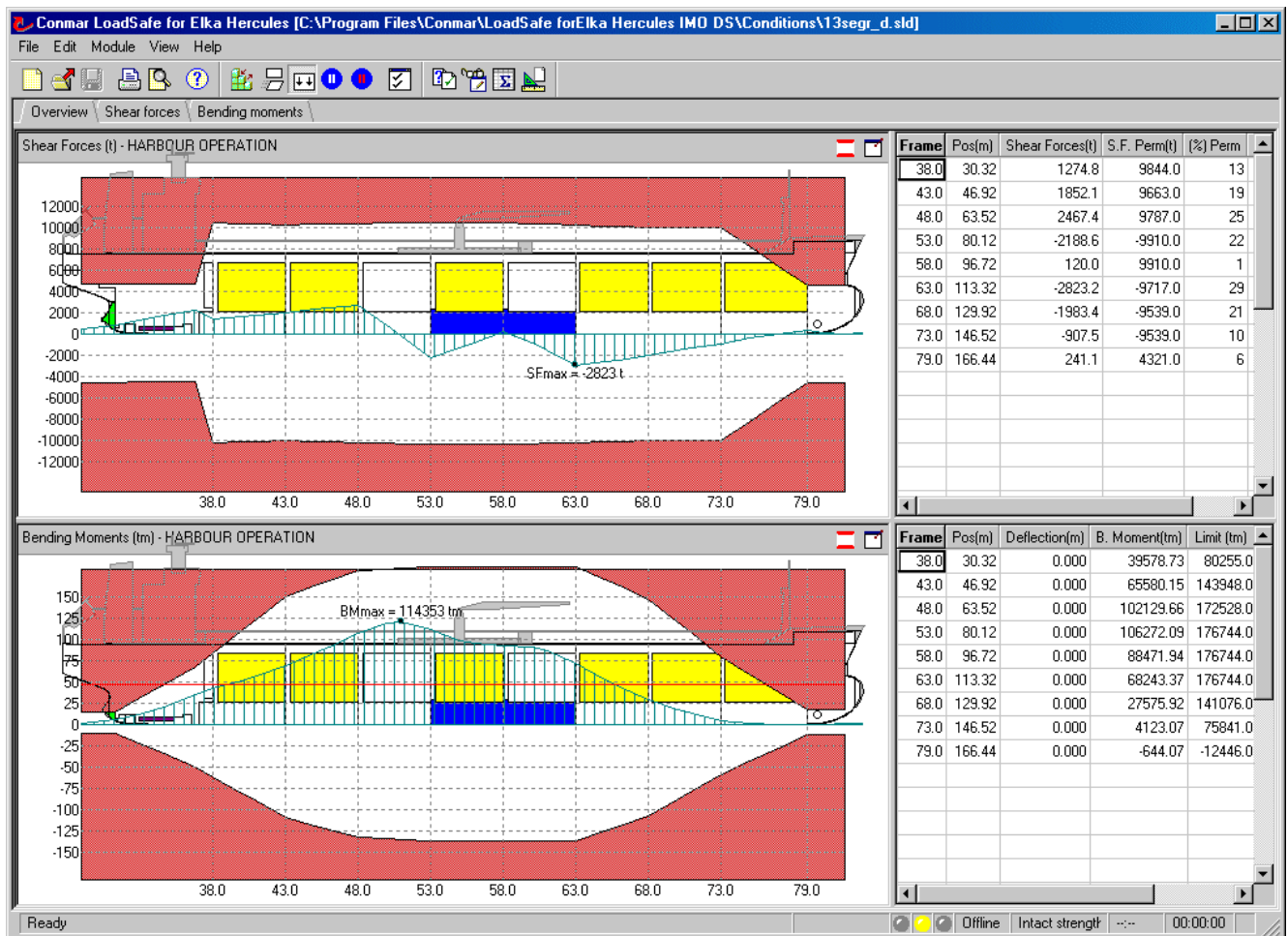
Ready

Offline Damage Scer 00:00:00

6. Longitudinal strength calculation

Still water shear forces and bending moments are being calculated for any loading condition at actual flotation as result of the static equilibrium of intact or damaged ship condition. Fourier series for longitudinal weight and buoyancy distribution is applied. Approximation of any particular weight as polynom of the first degree in sixty Fourier coefficients provide simple way to obtain approximated loading distribution as superposition of the total weight and buoyancy by adding Fournier's coefficients of the all particular weights and buoyancy. First and second integration of the approximated loading distribution give still water shear force and bending moment values at any point along the ship's length.

Checking of results is performed versus allowable shear forces and bending moments limits either in harbour, seagoing or damaged condition, as far as applicable.

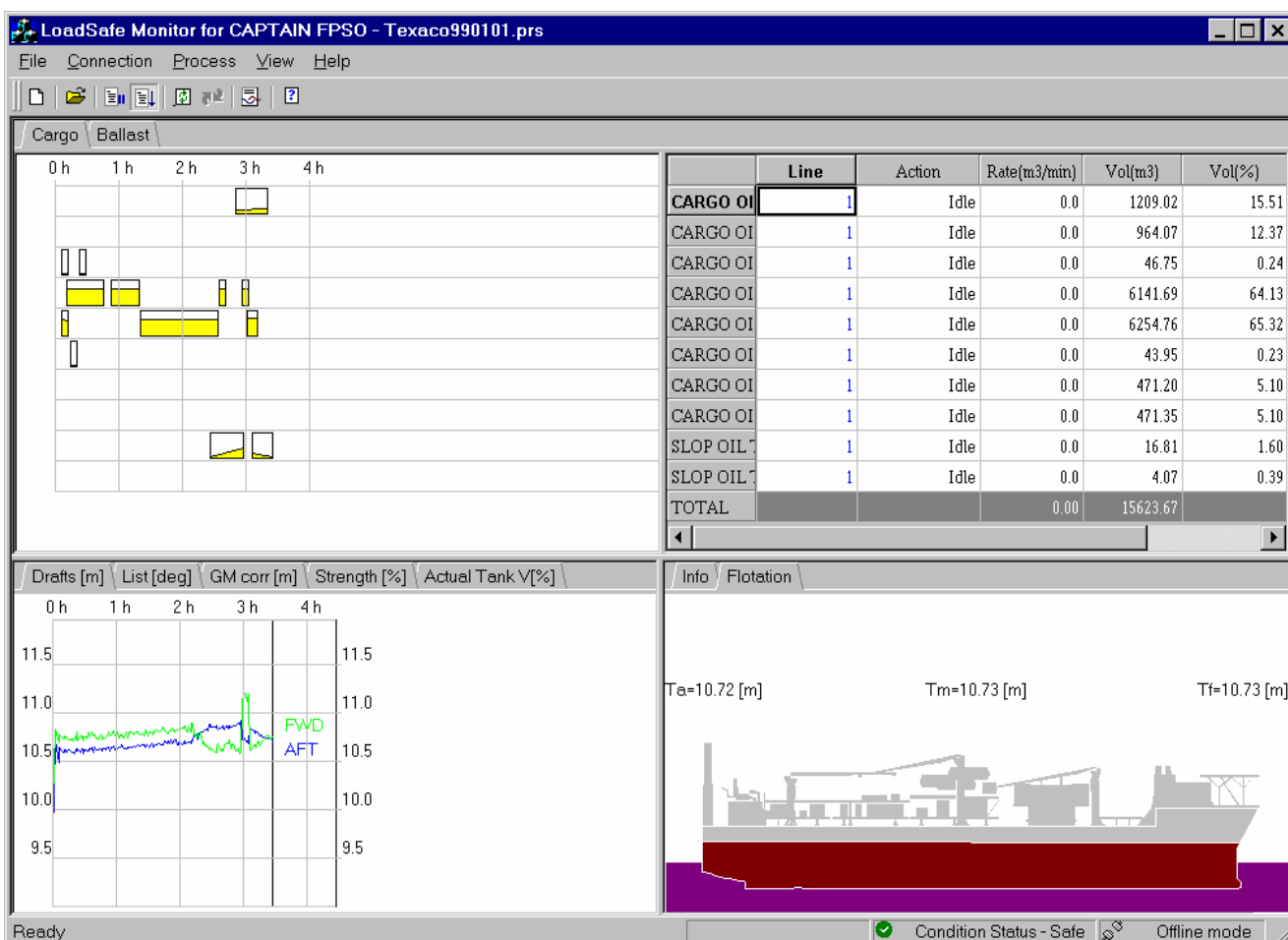


3. LoadSafe Monitor

This program has been developed as accessory to the LoadSafe cargo loading and damage control program, to enable online real time monitoring of cargo/ballast operations.

From measured parameters, software predicts monitored values for next hour, if existing operation parameters are maintained. Following values are monitored:

- Forward and aft mean drafts, in metres.
- List, in degrees (+ if portside, - if starboard).
- GM corrected for free surfaces, in metres.
- Maximum shear forces (SF) and bending moments (BM), as percentage of allowable values.
- Volume of liquid in the tank specified in the Tank Book, as percentage of maximum volume (indicated in the header):.



Software also displays information is for each tank in actual time:

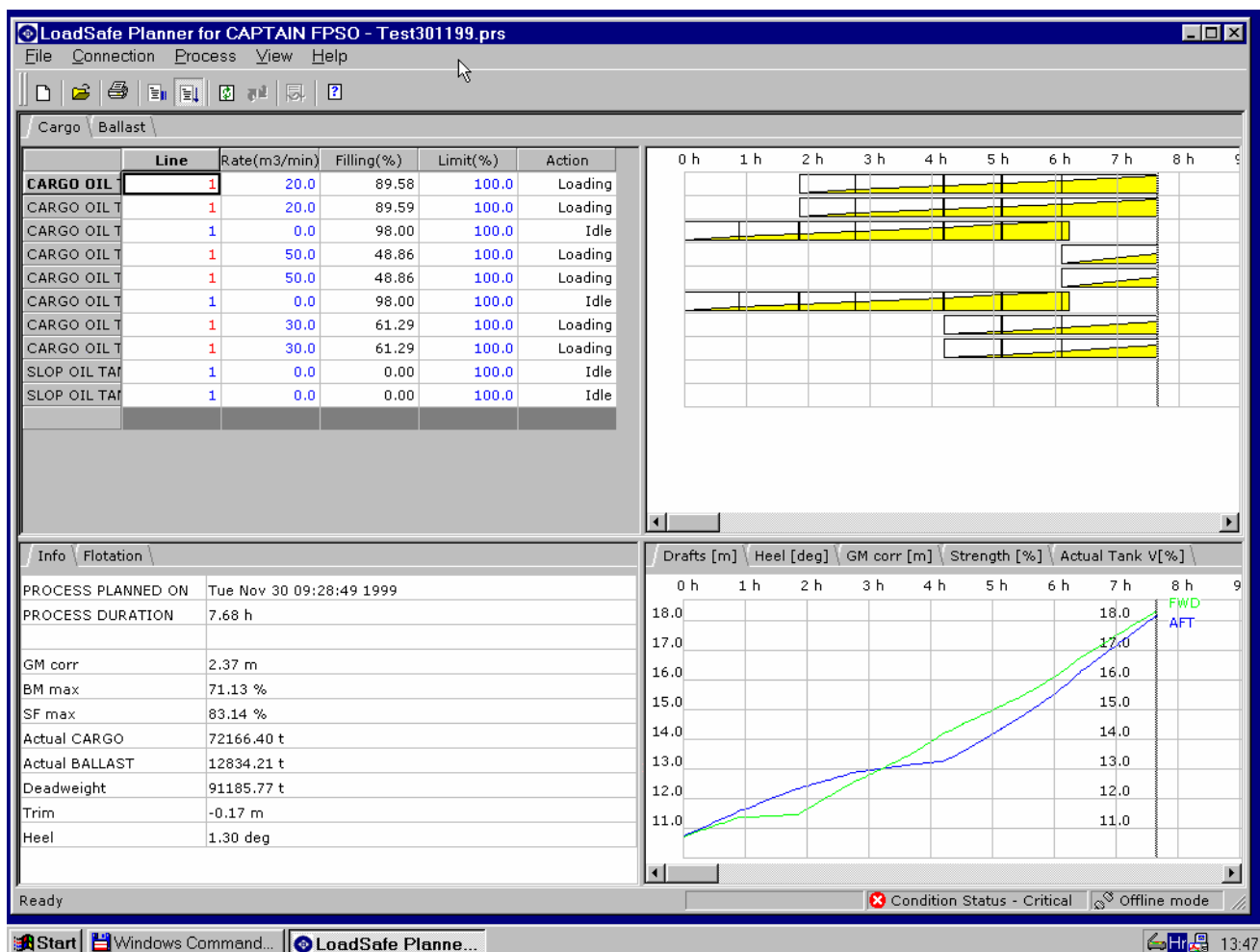
- Cargo/ballast line in use.
- Activity, which can be *Idle*, *Loading* or *Unloading*.
- Calculated rate of loading or unloading.
- Volume of liquid.

4. LoadSafe Planner

This program has been developed as accessory to the LoadSafe cargo loading and damage control program, to enable offline planning of cargo/ballast operations.

Users defines the loading rate of cargo or ballast tanks and the software forecasts evolution of :

- Volumes of liquid in tanks
- Flotation of the vessel (drafts)
- List of the vessel
- Initial stability (GM)
- Longitudinal strength



5. Licence

Bureau Veritas being only a commercial agent, licensing is made by Conmar which also takes care of maintenance and hot-line service.

For each ship the licence covers both the software and ship specific data.

Accordingly, with a single licence it is possible to install an unlimited number of workstations, whether on-board or ashore (testing, training...).

Each licence includes :

- A free maintenance and hot-line for twelve months
- User initial training during software commissioning which should not exceed one day.

NB : Knowledge in ship stability and longitudinal strength calculation are pre-requisite for this training.

6. Maintenance & Hot-line

Maintenance covers changes in ship critical characteristics (lightship ...) and software upgrades.

As far as needed these upgrades includes updated documentation and on-line help.

There is generally an ascending compatibility of software data. When needed an automatic upgrade tool is provided.

The hot-line service is available on a 7/7 24/24 basis.

7. Quality insurance policy

- The software has been developed and is maintained by Conmar according to its ISO9001 referential (certificate BVQI n° 79452)
- The software has been granted a LR type approval (certificate CLI/02/96 available until June 2007)

Bureau Veritas keeps a copy of software source code.

8. Quotation

The pricelist attached as annex A is given for information purpose only but Conmar is dedicated to adjust very precisely its offer to clients needs at lowest possible cost.

In that respect, when applying for the quotation please answer the following questions to enable proper answer:

- Type of the vessel: Tanker, bulker, general, container, ro-ro, passenger, gas, other (state type)
- Dimensions (L x B x H):
- Criteria to be applied and approving authority (class, flag, others – please state)
- If online input from tank gauging sensors, state manufacturer and which tanks are fitted with the sensors (cargo, ballast etc.)
- Damage stability: KGmax, direct IMO damage scenario calculation.

9. Commercial references

Up-to-date commercial references list (i.e. list of ships which were equipped with Loadsafe) is available from Conmar web site : <http://www.conmar.hr/>

Annex A Indicative pricelist

Module Type	Options	Price (Euro)	Extensions	Price (Euro)
Loader Dry or liquid cargoes	Default	3000 ¹	Cargo units (containers, cars etc.)	1000
	Online	1000	Volume corr. factors	500
	Quantity control	500	Grain calculation	1500
	Stowage plan (dry cargoes)	1500	Grain (calculated)	500
Intact Dry or liquid cargoes	Strength	1000	KGmax assessment	1000
	Stability	1000	Hull deformation Criteria (HSE etc.)	1500 500
Damage - direct calculation Dry or liquid cargoes	Strength	1500	Hull deformation	1500
	Stability	1500	Criteria (HSE etc.)	500
Damage - direct calculation against IMO damage scenario Dry or liquid cargoes	Strength	1500	Hull deformation	1500
	Stability	2000	Criteria (HSE etc.)	500
Planner Dry or liquid cargoes	Strength	500	Criteria (HSE, etc.)	500
	Stability	500		
Monitor Liquid cargoes	Strength	500	Criteria (HSE, etc.)	500
	Stability	500		

All prices are given tax excluded in Euros

Explanation:

Each delivery includes at least Loader (3000 Euros). Prices of particular options and extensions shall be added to that basis price.

The prices do not include cost of approval by the class and/or competent authority.

Sister vessels will be granted a discount, depending on their similarity with first one.

Default criteria are IMO and MARPOL and they are not charged separately. Input of other criteria is charged only once for all modules.

¹ Specific discount applies to these fees when client is able to provide Conmar with a **good quality ship model** prepared with VeriSTAR Stability © software:

- model including only lines: 1000 € discount
- model including lines and capacity plan : 2000€ discount
- model including lines, capacity plan and regulatory loading conditions in line with approved "Trim and stability" booklet : 2500 € discount

Price of default Loader for special types of vessels will be agreed upon in each particular case.

Prices of special additional features required by user will be agreed upon in each particular case.

Annex B Conmar history

Conmar was established in May 1989 as first "one man show" private marine consulting and surveying company in former Yugoslavia. Since then it developed in a reputable partnership company gaining confidence of its clients in Croatia and abroad.

There are three main activities within the company, which are complementary among them.

Surveying covers all aspects of shipping and insurance surveying (P&I, H&M, cargo). Conmar covers almost all surveying activities on behalf of major world insurers on Balkans directly or as correspondent.

Consulting is oriented to technical and economical aspects of shipping as well as assistance in introduction of ISO 9000 standards to all types of companies. In that respect Conmar assisted more than 50 companies in Croatia and abroad to obtain ISO and/or ISM certification.

Programming is based on synthesis of skill and knowledge of older staff with programming aspirations of younger staff. In 1992 Conmar started development of LoadSafe cargo loading and damage control program as response to USA OPA-90 requirements and rapid changes of maritime regulation.

Due to war in Croatia and decrease of Croatian cargo ship fleet Conmar had to look for jobs on foreign markets and it was found mainly in offshore activities.

In 2002 contract with BV was signed for development of VeriSTAR Stability program.

Now Conmar has permanent staff of six persons, with four persons more working on part time basis. Thanks to partnership with Bureau Veritas, prominent shipowners and state organisations, Conmar experienced a sustained and continuous growth all over past years.