ULIVES PROJECT 2007-2012

Artic Inland Navigation Ship Design Risks

Why ?

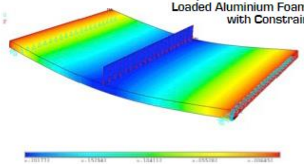
http://www.iwu.fraunhofer.de/en/metal-foam-center.html

http://www.e-lass.eu/en/Sidor/default.aspx

Technical Data Sheet

Density of the core 0.22-0.38 g/cm3
Compression strength rel. density 2.0-9.0 MPa
Minimum Density AFS (15 mm) 0.47 g/cm3

Computational Results of a Centrally Loaded Aluminium Foam Steel Sheet with Constraints



Sandwich Thickness [mm]	Sheet Metal Thickness [mm]	Total Mass [kg]	Max Deflection by Self- Weight [mm]	Max Comparison by Self- weight [N/mm²]	Max Deflection [mm / 1000 N]	Max Comparison [(N/mm²)/1.000N]	Light Weight Construction Factor LBF = 1/(mass·deflection)·1000
15	2	58.7	0.523	3.99	1.447	14.7	11.8
20	2	63.9	0.299	3.02	0.759	10.2	20.6
25	2	69.2	0.198	2.48	0.466	8.0	31.1
25	3	90.6	0.195	2.42	0.349	6.4	31.6
30	2	74.4	0.144	2.14	0.314	6.7	42.8
30	3	95.9	0.137	2.03	0.233	5.4	44.8

Further technical data available on request

LaffComp
material science division

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Email: materials@laffcomp.fi
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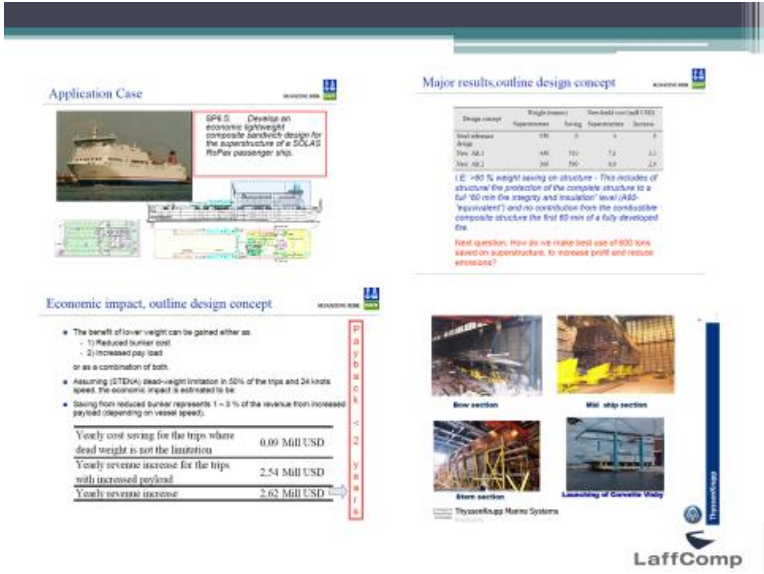
Web: www.laffcomp.fi



FEASIBILITY STUDIES

base for Risk Analyses

- General Development
- Operation Area
- Transport Volumes
- Competition
- Cost comparisions

INLAND WATERWAYS

FINLAND

The Finnish waterways are made up of four main networks of lakes and connecting navigations, totalling 7842km, of which 814km are open to vessels drawing 4m or more. Commercial traffic amounted to about 3 million tonnes in 2007, while about half a million passengers were moved on the inland waterways. Almost half of the above length is accounted for by the Saimaa or River Vuoksi basin, which extends from Lappeenranta in the south-east to Nurmes and Iisalmi in the north (half way to the Arctic Circle!). This lake system was connected to the Gulf of Finland through the Saimaa Canal, first built in 1856 for a maximum capacity of about 300 tonnes. The so-called second building began in 1927 and was almost 40% complete when the Winter War (1939–40) interrupted works. It was planned for vessels of 1000 tonnes. World War II stopped all works. The third building started in 1963 and the canal was opened to traffic in August 1968. It was planned for vessels of 1600 tonnes, but today vessels of maximum dimensions can carry 2500 tonnes. Finland leased the Soviet

Rail /Road /IWW

Benchmarking the design drivers

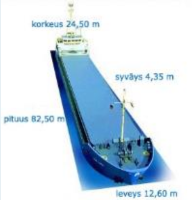
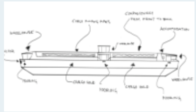
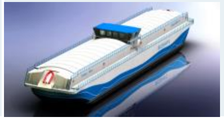
	EU	USA	JAPAN
Road	**74,3 %**	38,1%	55 %
Rail	9,8 %	**48 %**	4 %
IWW	15,9%	**13 %**	41 %
LPI /World Bank		9	10

Inland Ship Design

Benchmarking the design drivers

Country	Inland route kms	Inland freight Road/Rail/IWW	World Bank LPI - 2014	Trucks /1000 inhabitant
France	**8500**	81/15/4	13	87
Finland	7842	**74/26/0**	**24**	93
Holland	5046	**58/5/37**	2	59
Germany	4350	66/23/11	**1**	**33**
Sweden	1165	62/38/0	6	56
Spain	**0**	95/5/0	18	**114**

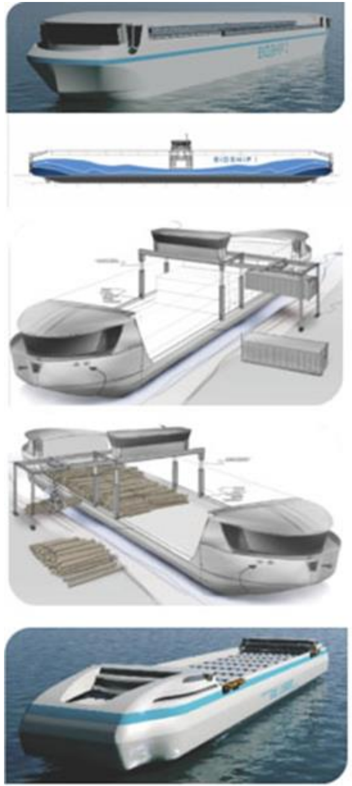
IWW versus Rail Development in Finland

Delopment	1850	1950 / 1960	2000	2007	2020
Rail	Steam	Diesel 	Electricity 	- 	Fast speed rails
Inland 	Saimaa Channel / first steam ships 	Re-opening Saimaa channel 	Regression : Not following the main transport development 	EU Lass projects : Composites to ship construction 	Ultra light ships – New EU traffic strategy

IWW versus Trucking

Keitele Päijänne area with ULIVES Design Ships

Wood chip & peat Transport at Jyväskylä power plant max 5 mill/m3 /year	**2 ships 24hrs/day 365/days a Year**	**25 trucks 24hrs/day 365/days a Year**
Investment 30 years	40 mill €	37,5 mill €
	17 persons. = 1,5 mill€/v.	136 persons= 7,5 milj. €/v.
Distances to drive/sail / year.	142 000 km	7 mill. km
Fuel consumption	1 000 000 litres (600 hv/0,13 lt/hp/hrs speed. 6 knots)	2 800 000 litres (40 litres / 100 km speed. 50 km/t)
Loading /dischargin	Own equipment: pneumatitic system; no harbour facilities required.	Loaders required in each loadplace
CO_2 And LCA / LCC	Project with lappeenranta University commenced 2.1.2008 - complete 31.12.2008	



Feasibility Summary (2008)

item	Result
General Developement	Sustainable development According to EU and Finnish Traffic Ministry . Fully according to their strategies
Operation Area	First Ship Keitele Päijänne Next ones to Saimaa
Transport Volumes	For first ship min 2 mill m3 wood chips/peat /annum. (Jyväskylä Energy Plant)
Competition	Trucking / cost less than Trucking even in very short voyages.

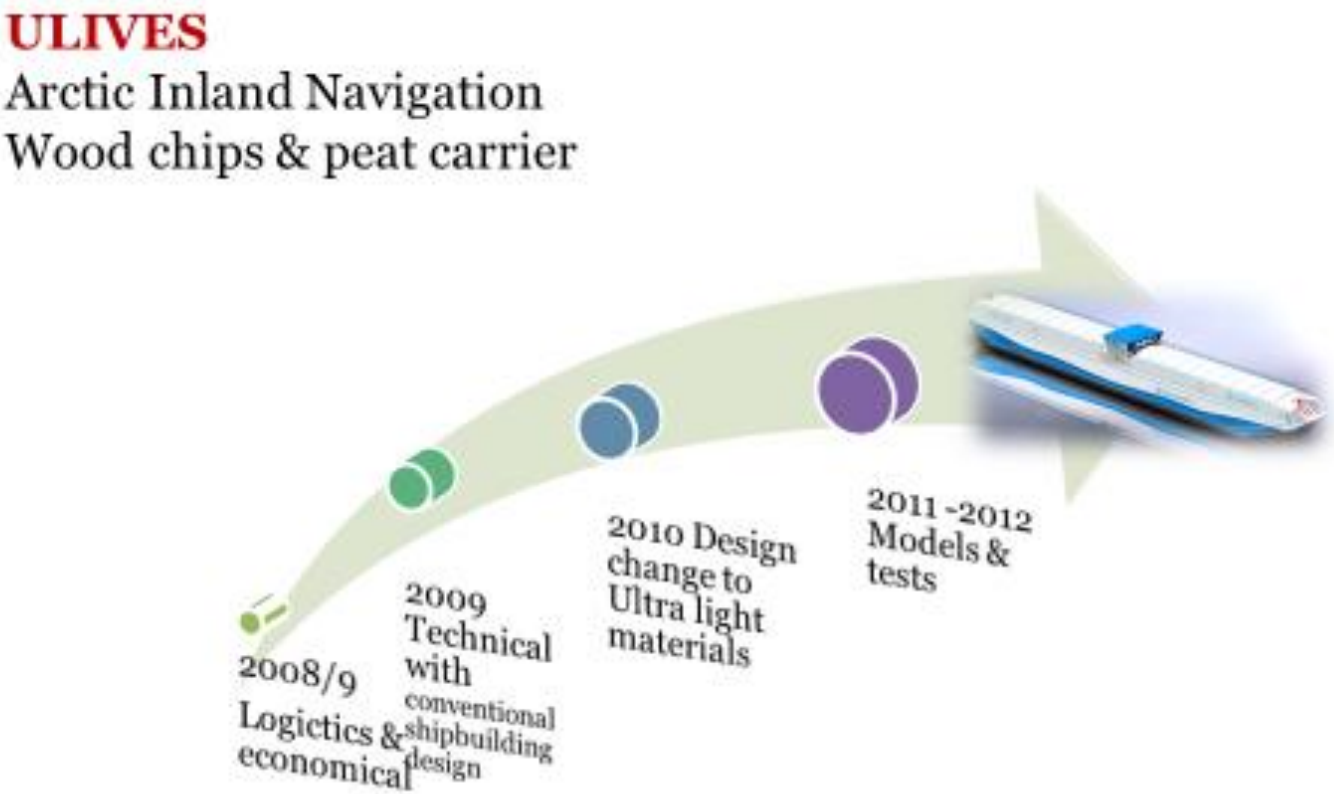
ULIVES

ULIVES =
Utra

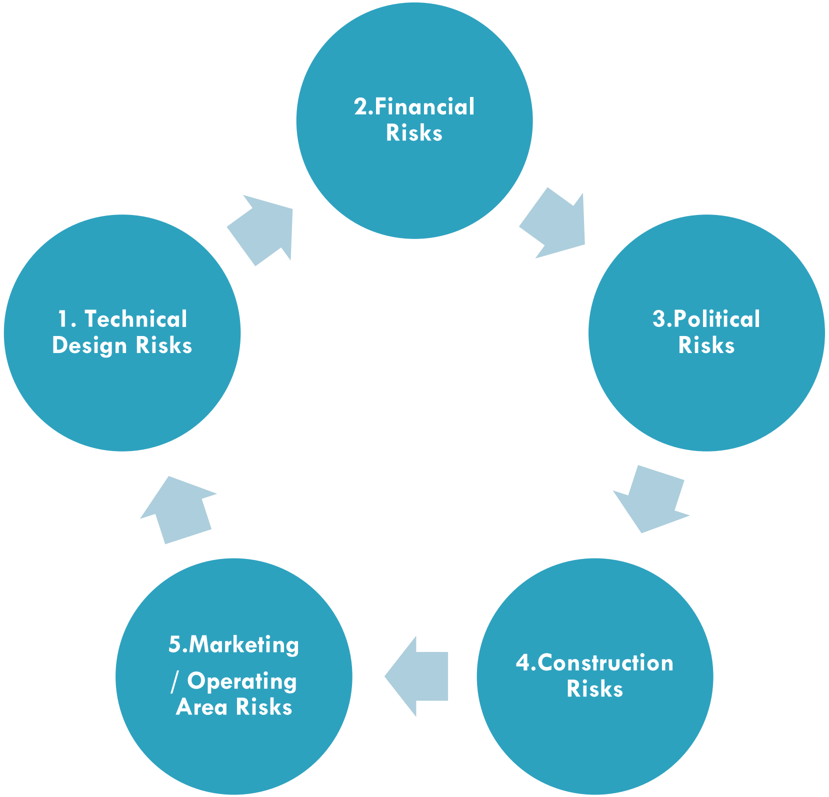
Light

Icegoing

VESsels

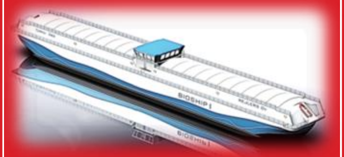


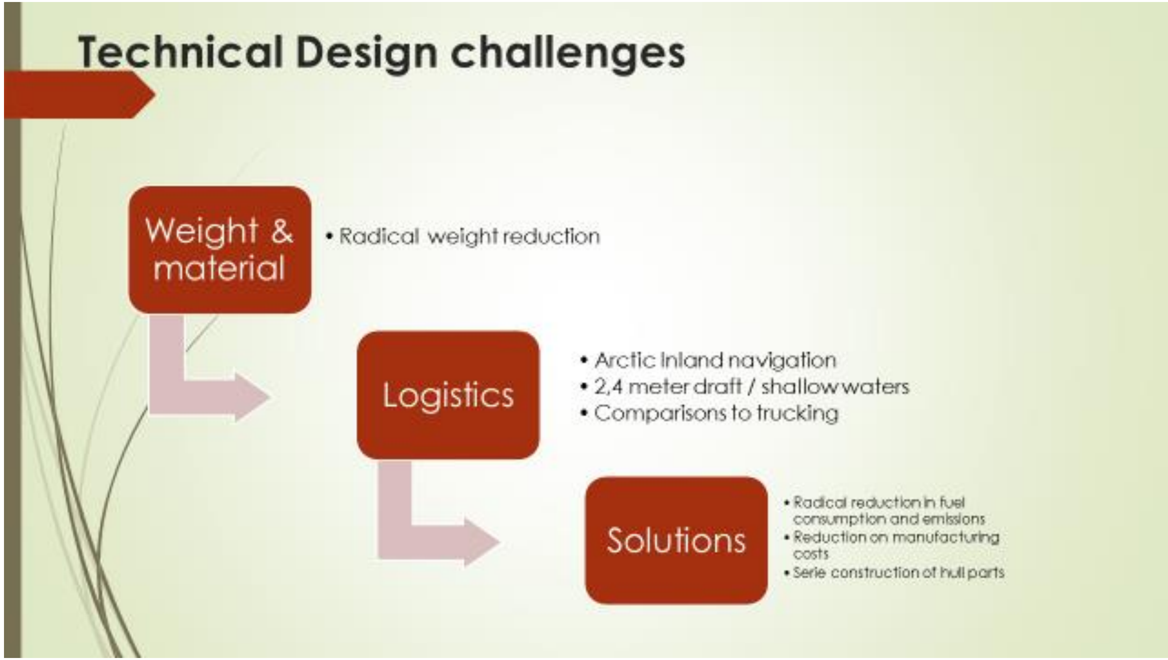
Design Risks/based on feasibility



1. Technical Risks

120 m long vessel
6000 tons steel for
Arctic Survey vessel





Operation & technical design requirements

Operating area & frequence

Level of automation

Cargo

Amount of personnel onboard

Ship

Class requirement

Ultra Light Hull

Ship Tech design

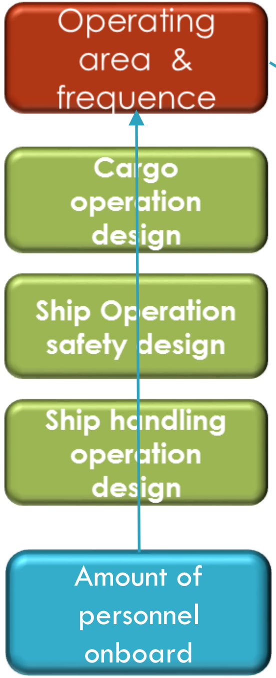
Cargo operation design

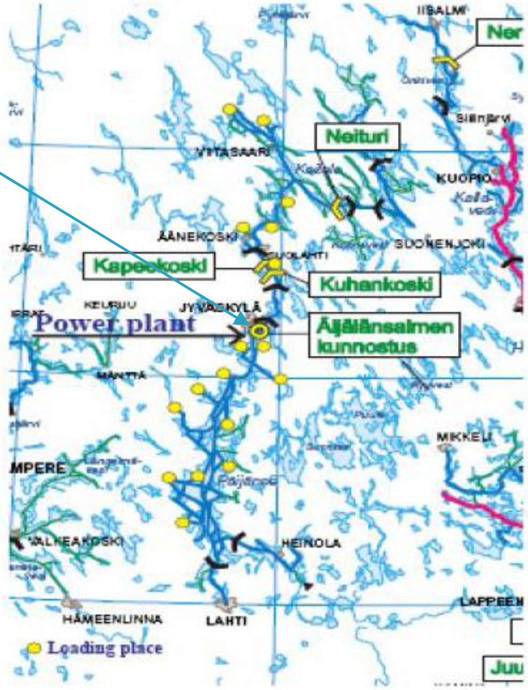
Ship Operation safety design

Ship handling operation design

LCC
LCA
Design

360/24 **safety** operation challenges

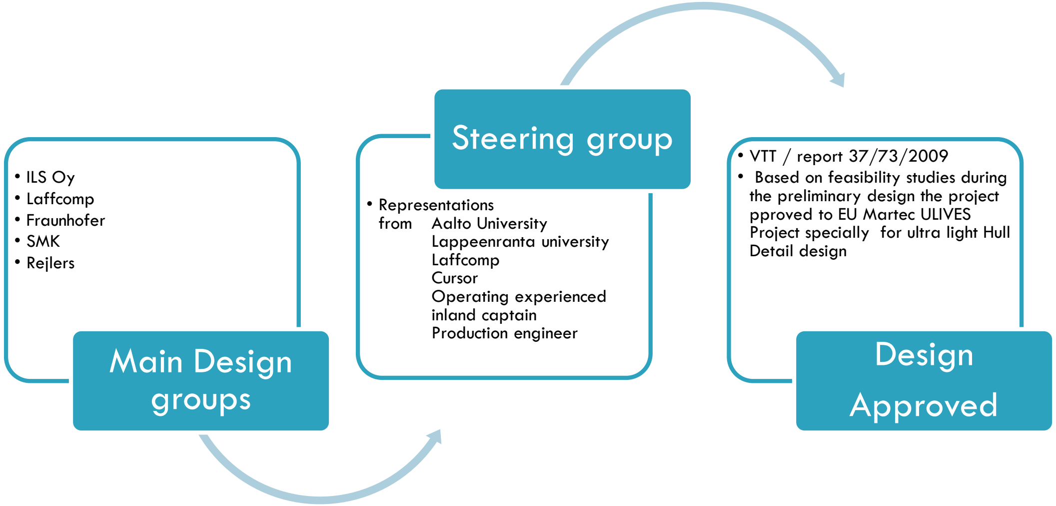




Human operation /working hours
Inland Operation area basic analyses
Short routes

max distance kms	no of locks	loading	discharging	roundtrip no of moorings
120	6	1	1	15
100	5	1	1	13
80	4	1	1	11
60	3	1	1	9
40	2	1	1	7
30	1	1	1	5
20	0	1	1	3

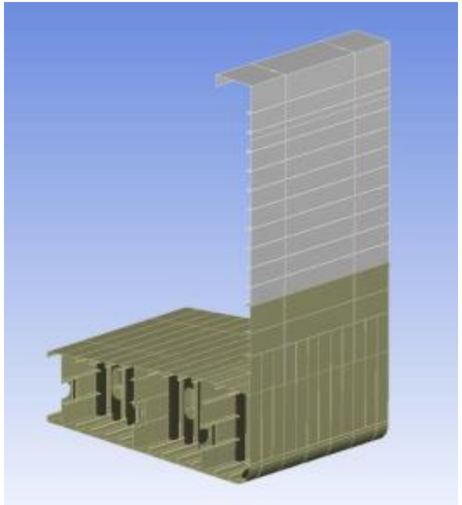
ULIVES Preliminary Design 2008-2010

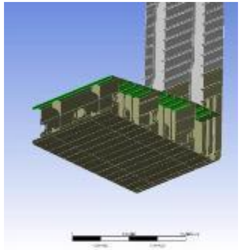


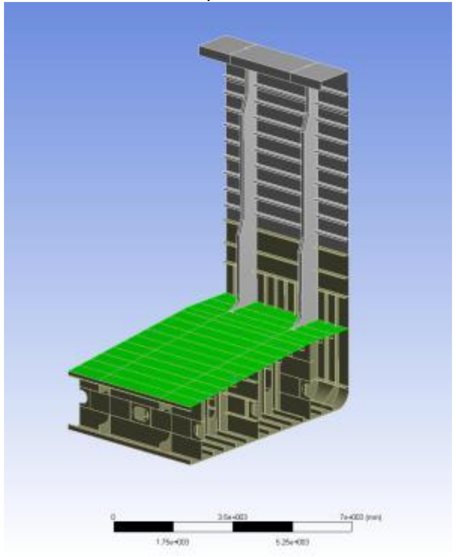
Detail Design

Desing change to Aluminium Foam Steel requirements
Result gained 27% reduction in hull weight by Fraunhofer institute.

GERMANISCHER LLOYD / Bureau Veritas " Rules for Inland Navigation Vessels
" GL + 100 A5 I IN (0,6) MC 6 Finnish Ice Class 1a Super







Exctracts from VTT (State research Center report no 37/73/2009) page 1/2

Level of automation

Cargo operation design

Ship Operation safety design

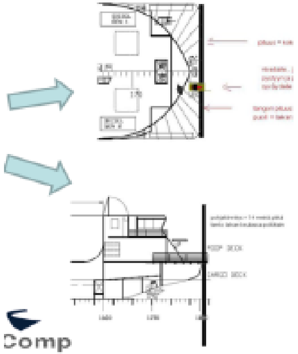
Ship handling operation design

0. **<u>Vessel mooring system</u>**

Similar systems are being used in dredgers etc. and working barges. The system is accurate and suitable for shallow water where the bottom is appropriate. The system is not usual in cargo vessels that normally are moored to quayside and in special cases on anchors.

When moored on anchor vessels move as far as allowed by the anchor line and such a mooring system could not keep this vessel on spot the way that is necessary for the loading system.

Due to this fact the bottom mooring system of the vessel **is an innovative application and,** in conditions with small wave and other such load, **probably a functional solution.**



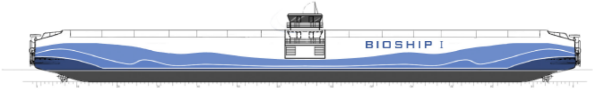
1. Lock system

In locks the vessel is moored on the walls of the lock chamber in order to prevent its horizontal movements during water flow, which could cause damages.

For this purpose the vessel is provided with remote controlled friction prevention equipment that locks the vessel in place but allows the vertical movement of the vessel by changing water level.

The usage of the system **decreases vessel personnel's time spent in the space between vessel side and chamber wall.** This semi-automatic system represents **new innovative thinking aiming at quicker action and better personal safety.**

page 2/2



Ultralight ice going multipurpose lake and river vessels

Cargo operation design

Ship Operation safety design

Ship handling operation design

2 and 5 Pneumatic loading and unloading system

The system as such does not represent a new innovation but its application in the proposed transportation system, in which wood chips and peat are loaded from shore without loading equipment and constructions, is **a new innovative action.**

ULIVES - LCA / LCC design with Lappeenranta University

LCC
LCA
Design

LCA

In the study with Lappeenranta university it was examined the maximum volume of wood chip and peat, which one ship can transport in the time available.

The resulting fuel consumption and carbon dioxide emissions compared to the lorry carried out chips and peat transport fuel consumption and emissions.

Result = with the Ultra light desig hull ; vessel consumption can be reduced abt 54% compared to trucking

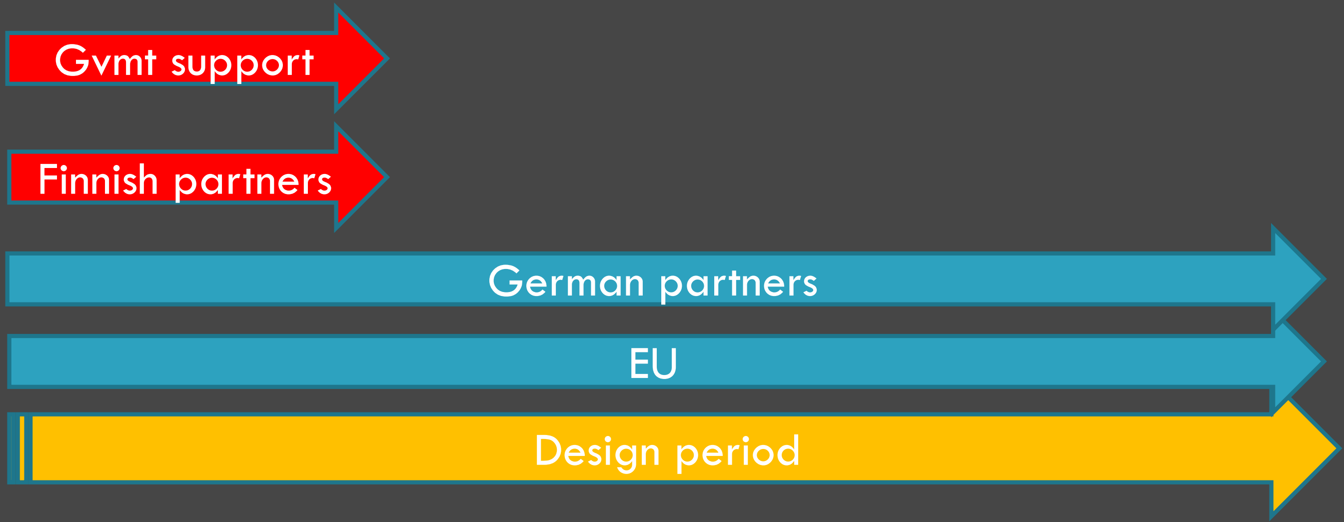
Result = with the Ultra light desig hull ; vessel emissions can be reduced abt % 66 compared to trucking

LCC

In the second sub project it was made the MS Excel-based model for calculating the ship's life-cycle cost calculation.

The model was defined for the possible restructuring scenarios, as well as modeled the ship's life cycle and breakdown of the structure.

New tool to estimate LCC for IWW



Financial Risks

3. Political Climate Changes

EU

2011

New Traffic Strategy in which min 50% of trucking to be moved to Rail and/or IWW

FINLAND

2007

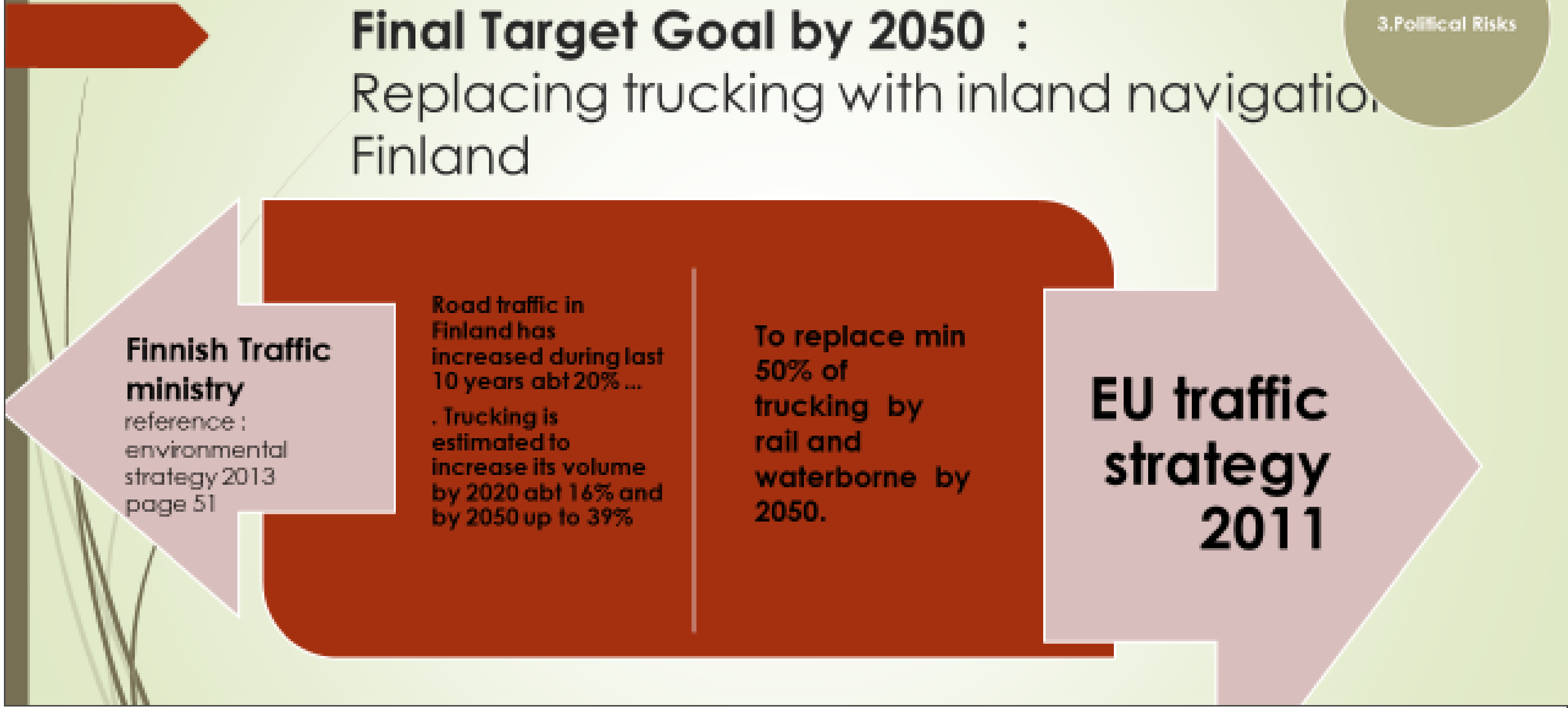
Traffic mininstry official Strategy for 2030 was to Increase rail and IWW volyme % shares in Finland

2011

Government changes officially their priorities to increase Trucking volumes

2014

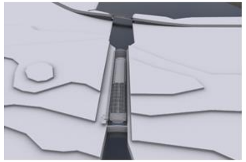
Sos Dem party approves in party meeting into their party program to Develope IWW



Political Risk = Financial Risk = Risk Fully Realized

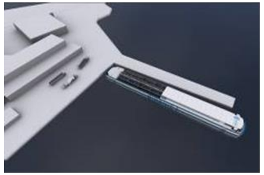
Ultra Light Arctic Ship Design in Finland 30.09.2014

4.(Remote Area) Construction

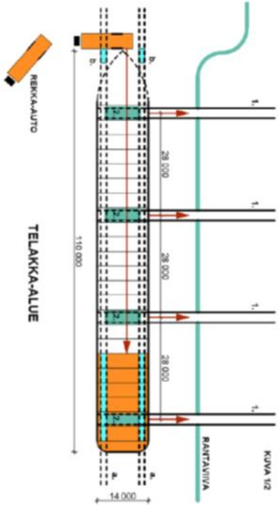


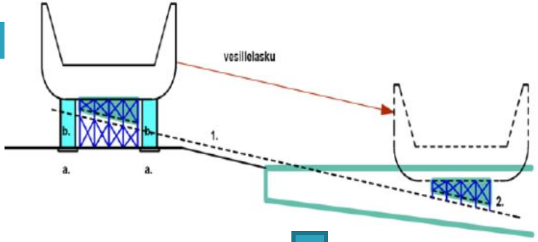
The sections to be assembled in the Paatela lock, in Jyväskylä or in Padasjoki
Laffcomp and/or
foreign shipyards and/or
Finnish shipyard infra-structure

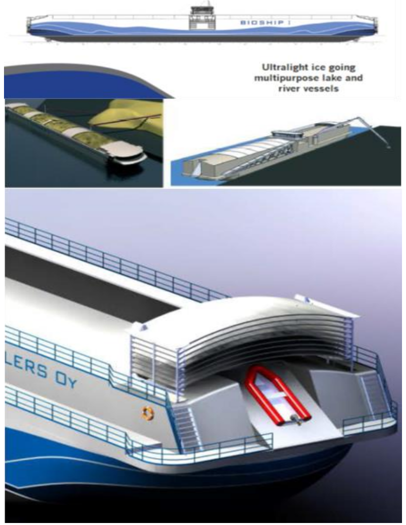
The sections to be transported from abroad by ship and from the port to the assembly site by truck or rail
Finnish transport companies



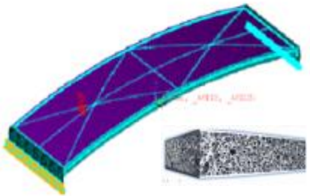
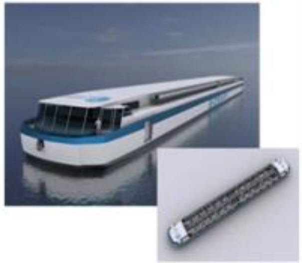
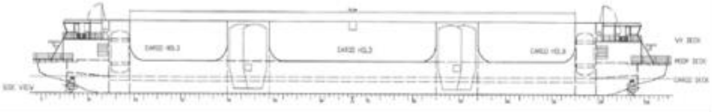
The sections are built either in the Kotka shipyard or by domestic or foreign subcontractors.
Laffcomp and/or
foreign shipyards and/or
Finnish shipyard infra-structure

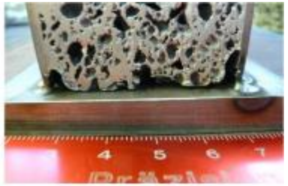


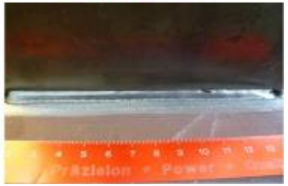
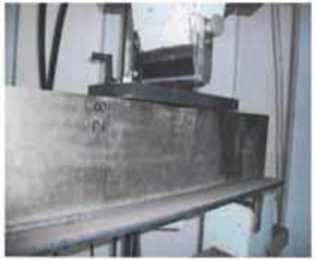




SMK GMBH   Welding   Studies & tests of Aluminium Foam Steel
DR. Peter Kauffmann



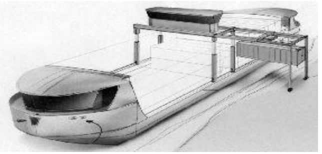
Constructed hull part :

Middle section 1:4 by Fraunhofer institute

Project completed 31.12.2012

5. Marketing / Operating Area

Domestic	Foreign Market
Open - waiting for Political climate change -	Negotiations in final stage to design ULV in serial production



http://mallioikeus.prh.fi/mallinet/mayksie.htx?maid=12979805&koko=1

References

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http://mallioikeus.prh.fi/mallinet/mayksie.htx?maid=12979805&koko=1&hhlist=b12976895b12979805

Summary of Risks by 2014

-	+

- Political Risks caused Project in Finland to be on hold

http://www.oikeuskansleri.fi/media/uploads/ratkaisut/ratkaisut_2014/okv_4_50_2011.pdf

- **Technical approval** by EU-Martec / German Julich and Finnish State Reseach center. Reached 27% Hull weight reduction when VTT estimated 5% max.
- **Logistical calculations** by Lappeenranta University and approved by Finnish State research Center
- **Sustainable development** according to Finnish State Research Center and lappeenranta University.

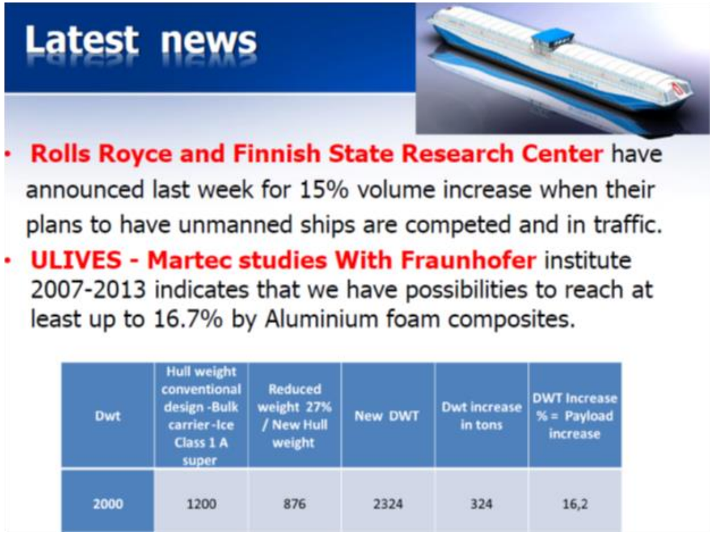
Page 11/12 : ……….Government has taken the traffic policy decision of the parliamentary term , in the spring of 2012 with the unclear data…..

Result of ULIVES Project

Created IWW-Sea going
Arctic vessel that is:

Future ?

http://www.bbc.com/future/story/20140818-robot-ships-poised-to-set-sail



Latest news

- **Rolls Royce and Finnish State Research Center** have announced last week for 15% volume increase when their plans to have unmanned ships are competed and in traffic.
- **ULIVES - Martec studies With Fraunhofer** institute 2007-2013 indicates that we have possibilities to reach at least up to 16.7% by Aluminium foam composites.

Dwt	Hull weight conventional design -Bulk carrier -Ice Class 1 A super	Reduced weight 27% / New Hull weight	New DWT	Dwt increase in tons	DWT Increase % = Payload increase
2000	1200	876	2324	324	16,2

THANK YOU


When We Get Together
There's No Limit
To What We Can Achieve Together..
LaffComp