A Modern Multi-Mast Gaff Schooner

The INDOSAIL Utility Sailing Rig

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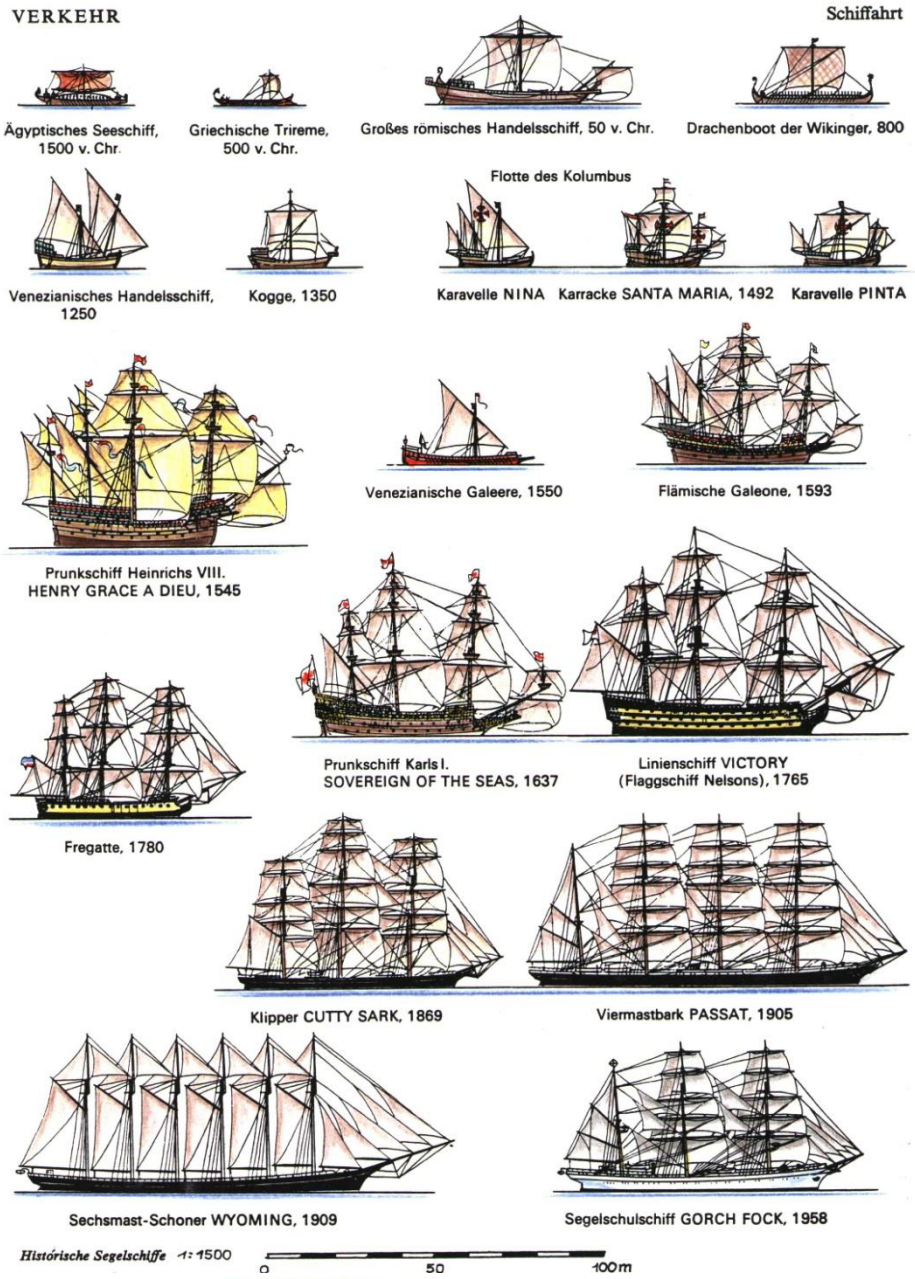
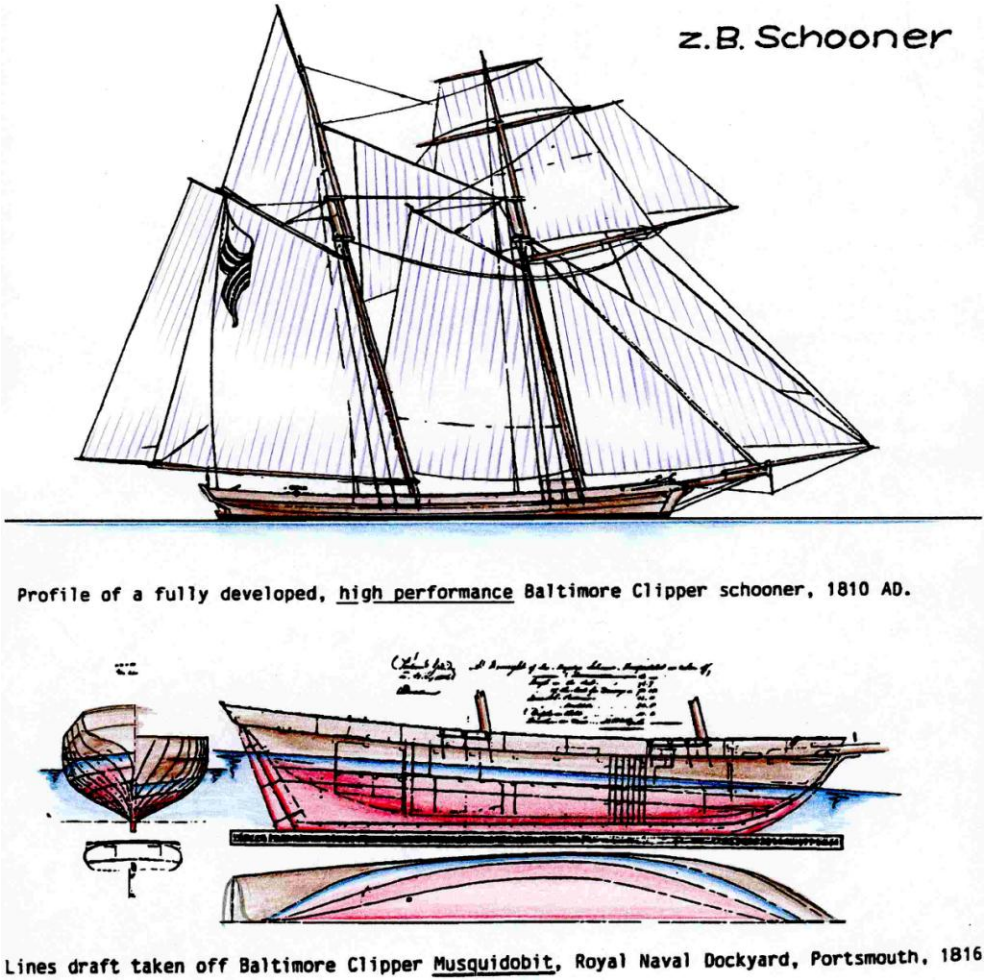


For~3000 Years. .

.. Sails were the Propulsors for Trade, Politics and for widening our Horizons.

The empirical Development was extremely slow and dominated by the Square SailType.

The ‚Baltimore-Clippers' ~ 1800

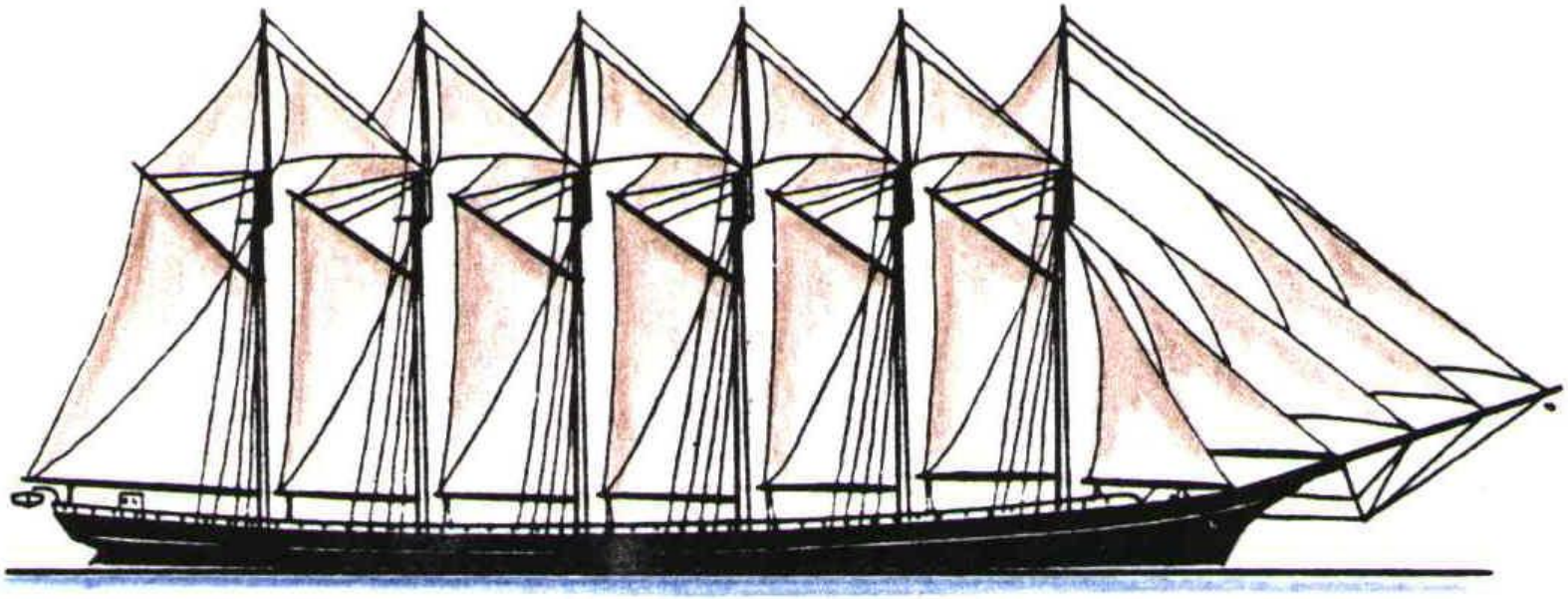


‚Clipper' means ‚Cutter'. .

. .and also the tall and fine ‚Clipper Ships' were developed from the fast Coastal Schooners between Baltimore and Newfoundland.

The 'Windward Helm' due to the huge Sailing Rig could be controlled by due ‚Rake of Keel'.

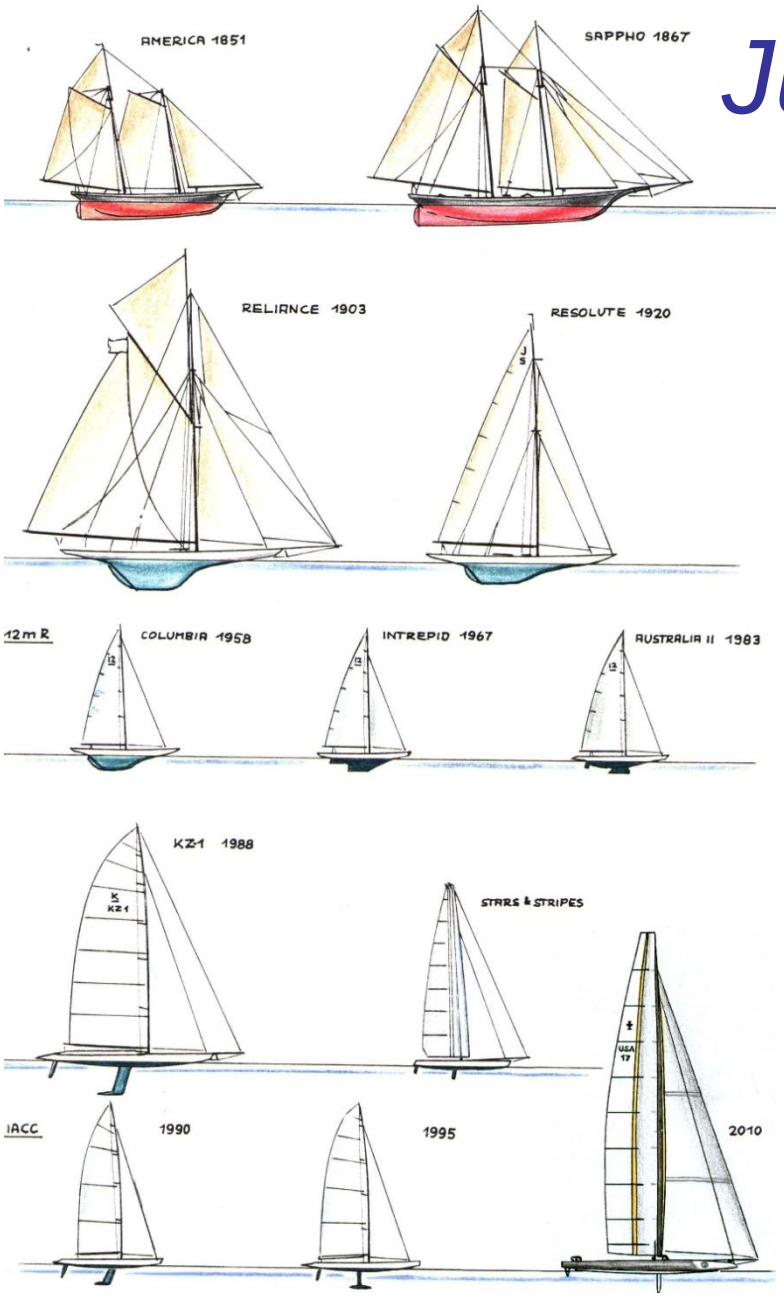
The American Multi-Mast Schooners ~1900



Six-Masted Schooner **WYOMING, 1909**

One of the last peaks of the empirical ‚know-how' in Commercial Sailing were the wooden and steel-built and low-manned Multi-Mast Schooners trading the American east cost.

On rough offshore routes however, their Gaff-Rigs were not controllable and reliable enough to compete with the Tall Square-Riggers.



Just 100 Years ago. . .

..when we gave up Commercial Sailing, we just started to understand, why ‚Sailing Up-Wind' works and how we could do better.

This new ‚Know-Why' could then be used for Sports and Pleasure only.

~150 Jahre AMERICA'S CUP

A New Effort for Sustainable Sea Transport

Traditional Indonesian Cargo Sailer

In 1980 Indonesia put forward a proposal for a bilateral R&D project named ‚Solar Ship‘.

In the first Phase, called ‘INDOSAIL’, a modular and efficient Coastal & Inter-Island Cargo-Sailing Vessel should be developed.

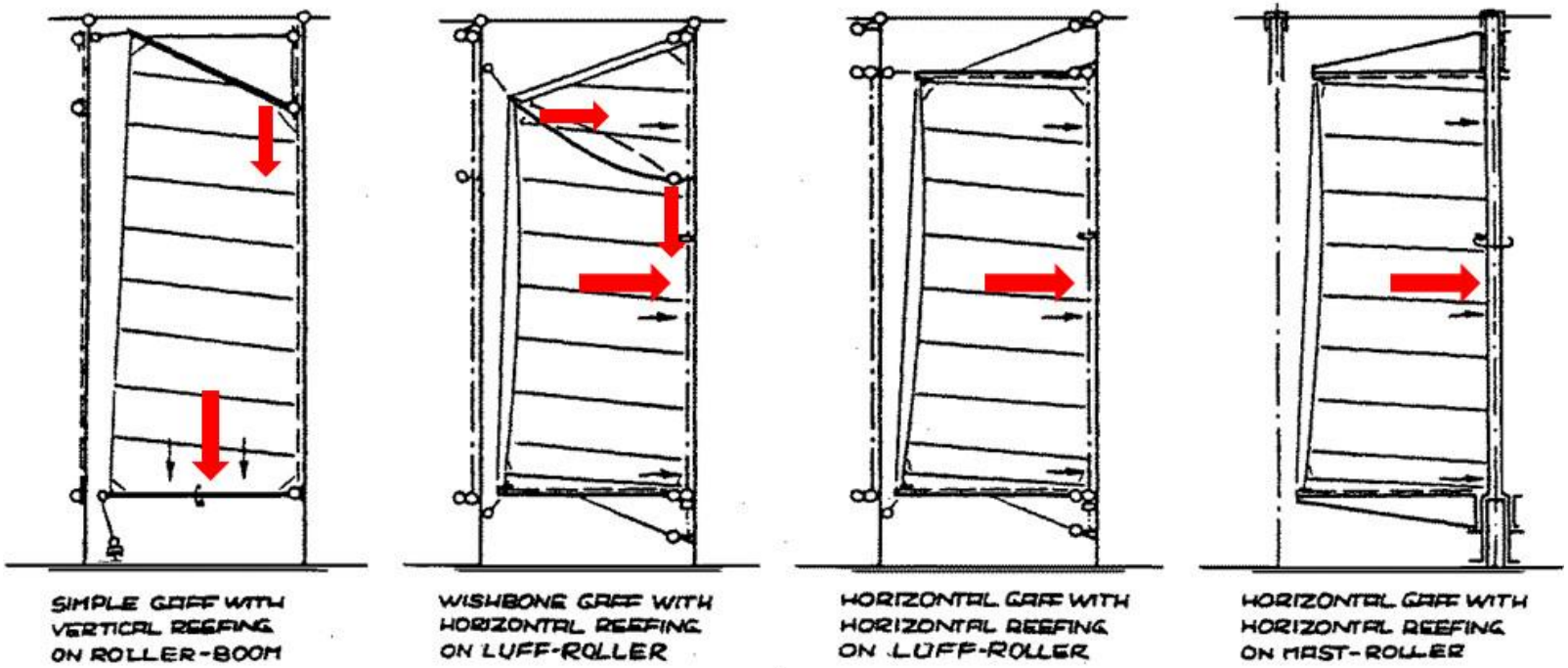
A Modular Multi-Mast Sailing Rig

A modular hull configuration calls for a Modular Sailing Rig.

The rectangular space between the masts of a Multi-Mast-Rig lends itself for alternative Gaff-Rig-Types.

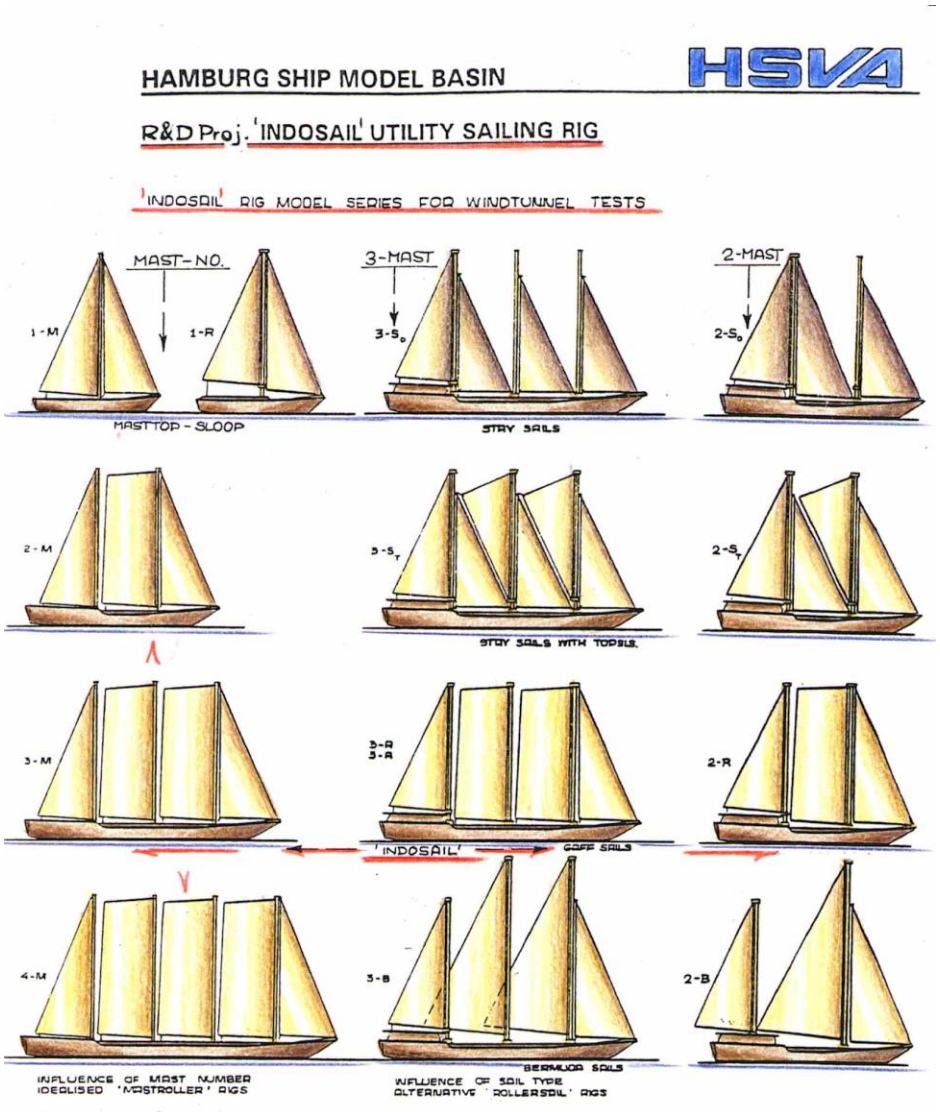
Various options of Mechanized Roller Sails were investigated:

Gaff-Sails as Boom-Roller-, Rod-Roller-and Mast-Roller-Sails were considered.



DIFFERENT CONFIGURATIONS OF GAFF RIGS WITH ROLLER-REEFING

A Modular Multi-Mast Sailing Rig

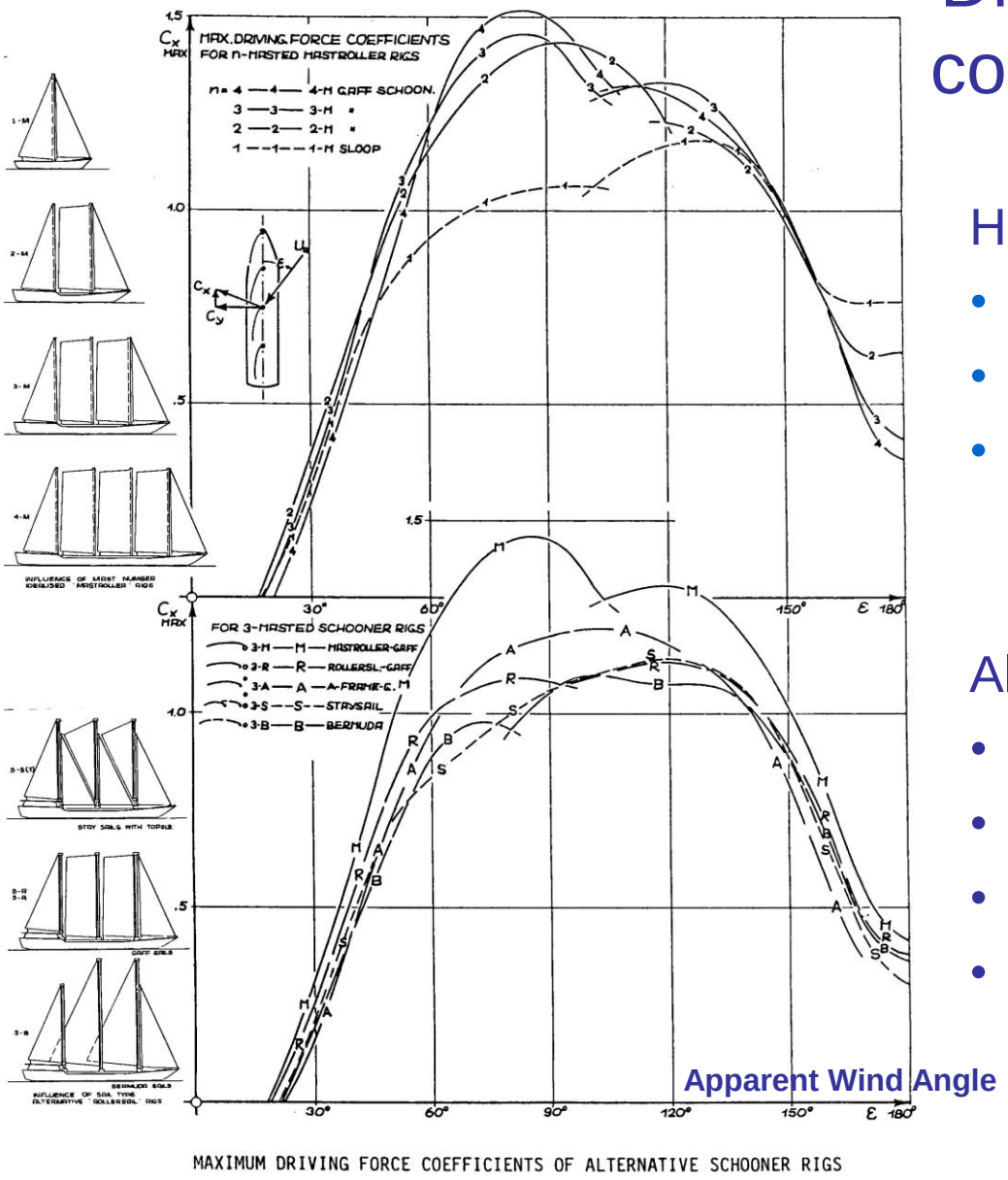


A modular hull configuration calls for a Modular Sailing Rig.

In a preliminary study, the aerodynamic performance of Mast-Numbers and alternative Rig-Types were investigated in the Wind Tunnel:

- Stay-Sails
- Gaff-Sails as Mast-Roller and Roller-Rod Sails
- Bermuda-Sails

Driving Force Components compared versus heading:



MAXIMUM DRIVING FORCE COEFFICIENTS OF ALTERNATIVE SCHOONER RIGS

Higher Mast-Number:

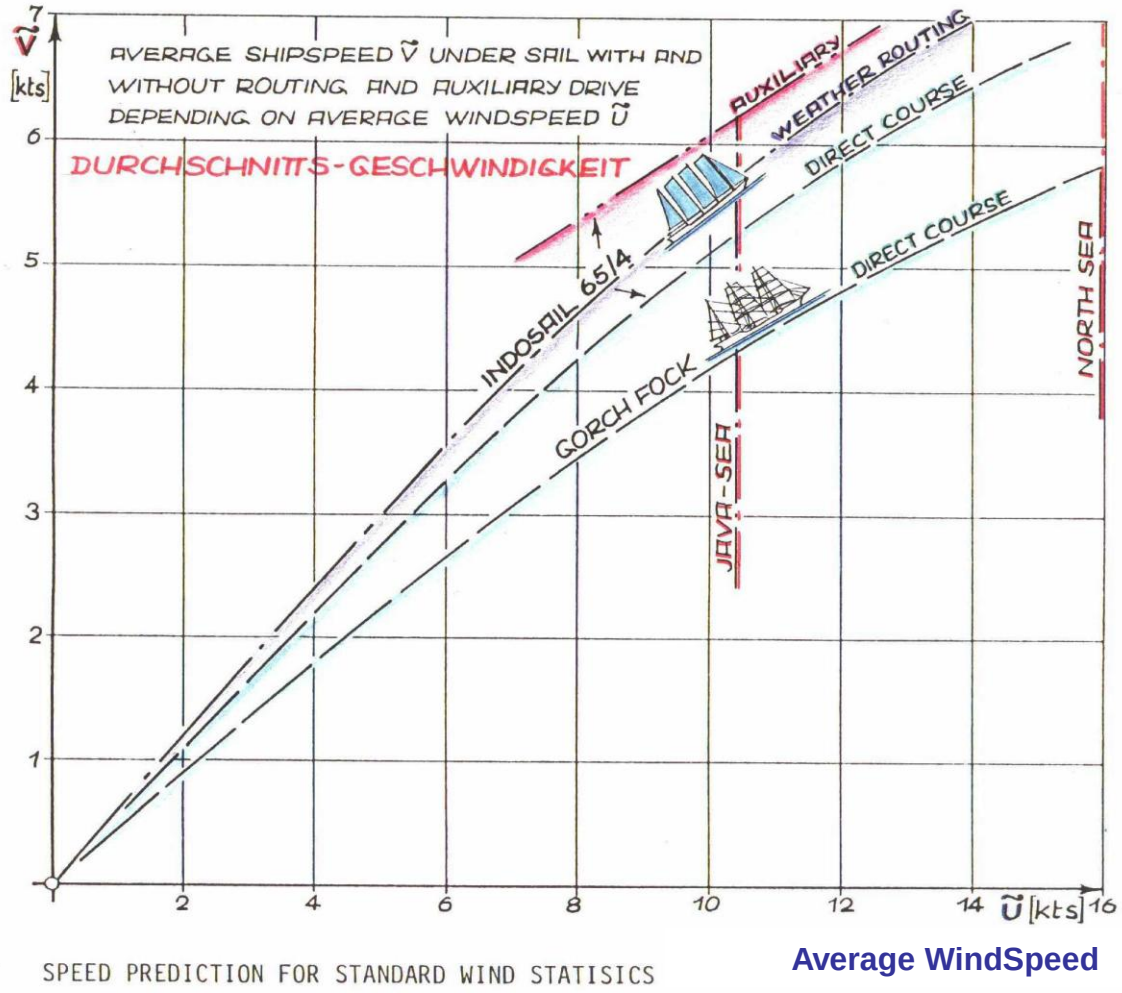
- slight draw-back up-wind,
- slight advantage reaching,
- heavy loss dead down-wind.

Alternative Rig Types:

- Mast-Roller best throughout,
- Roller-Rod Gaff-Sail second,
- A-Frame only on broad reach
- Stay-Sail & Bermuda less effic.

Roller-Rod Gaff-Sail type selected as **INDOSAIL Rig**

Average Round Trip Speed



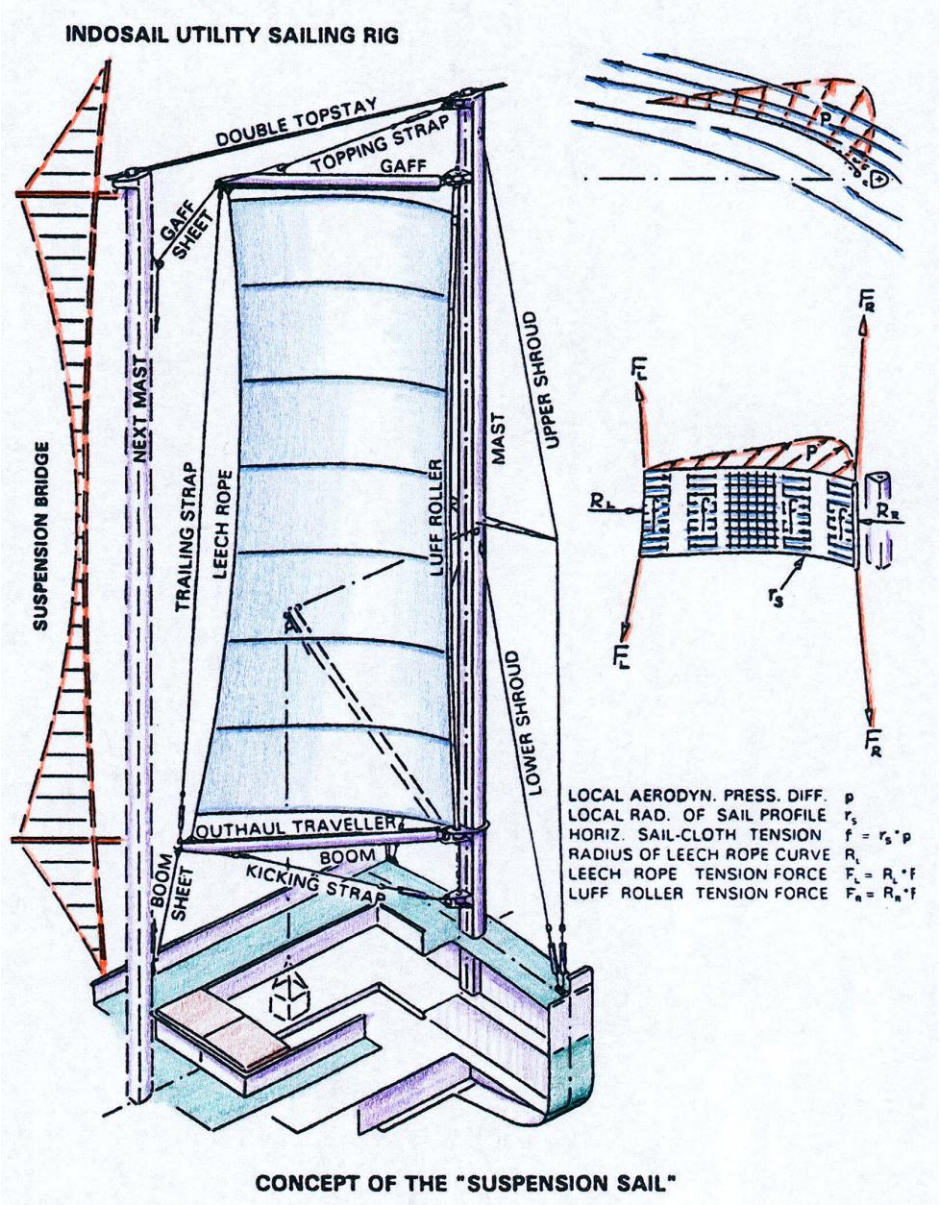
SPEED PREDICTION FOR STANDARD WIND STATISICS

Average WindSpeed

Since the ideal Mast-Roller seemed too complicated, the easier Roller-Rod Gaff-Sail was selected for INDOSAIL.

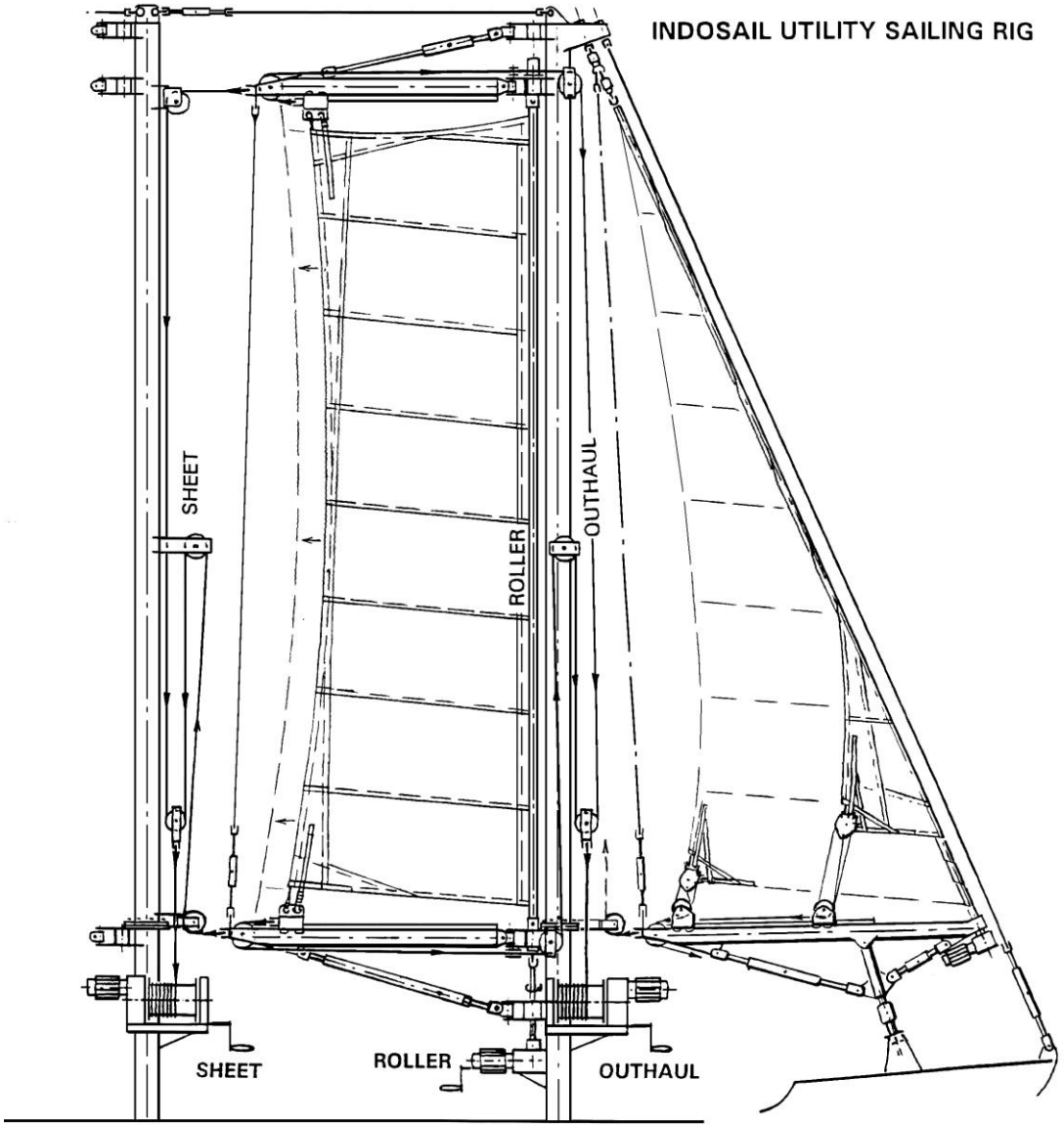
A prediction of Average Round-Trip Speed shows ~20% increase against traditional Square Rigs and another 10% each for routeing and motor assistance.

Advanced Control of Sail-Size, -Shape and -Position



- by pre-tensioned frame of mast, boom, gaff and trailing strap,
- by wide range sheeting of boom and gaff,
- by continuous outhauling and roller-furling,
- by simple-cut and hollow-leech **‘Suspension Sails’.**

Easy Handling by Mechanised Operation



SCHEMATIC OPERATION SYSTEM

All three functions:

- Sheeting of Boom & Gaff,
- Outhauling the Leech,
- Rolling the Luff,

can be mechanised on various levels:

- Hand Winches,
- Captive Winches,
- Local Control from Deck,
- Remote Control fr. Bridge,
- Automated by Computer.

Safety by ‘Sheets-Off’ button.

*3-Masted **INDOSAIL** Manned Model*

The Towing-Tank Model of the INDOSAIL Prototype Vessel was rigged up with a 1:8.5 scale 3-masted fully functional sailing rig:

Loa	7.4 m
Lpp	5.9 m
B	1.4 m
D	0.76m
T	0.53m
Displ.	2.6 t
Sails	14.5 sqm

2-Masted Experimental Cutter

To gain first operation experience, a 2-mast half scale rig was tested on a handy Experimental Cutter:

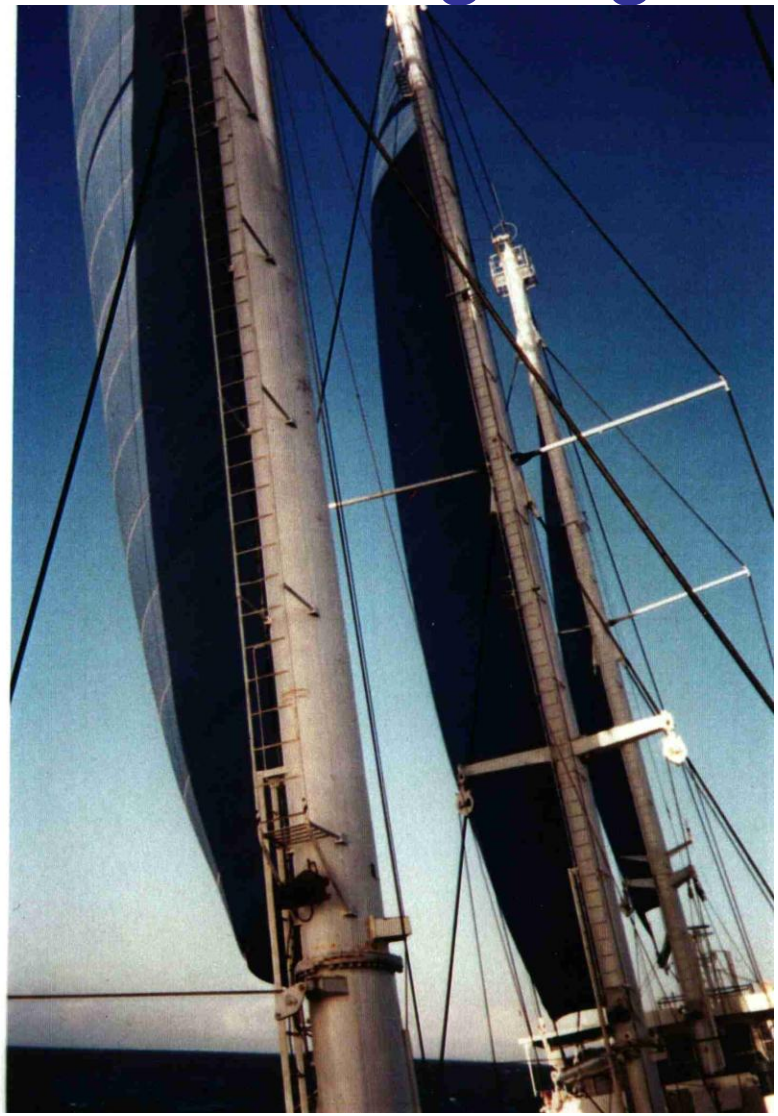
Loa	25 m
Lpp	20 m
B	6 m
D	3.5m
T	2.0m
Displ.	100t
Sails	200 sqm

3-Masted Prototype Cargo Sailer

The Prototype Vessel for coastal and inter-island cargo trade was built as the smallest 3-mast version with 2 hatches:

Loa	63 m
Lpp	50 m
B	12 m
D	6.5m
T	4.5m
DWT	900 t
Displ.	1600t
Sails	1050 sqm

A Modern Functional Sailing Rig

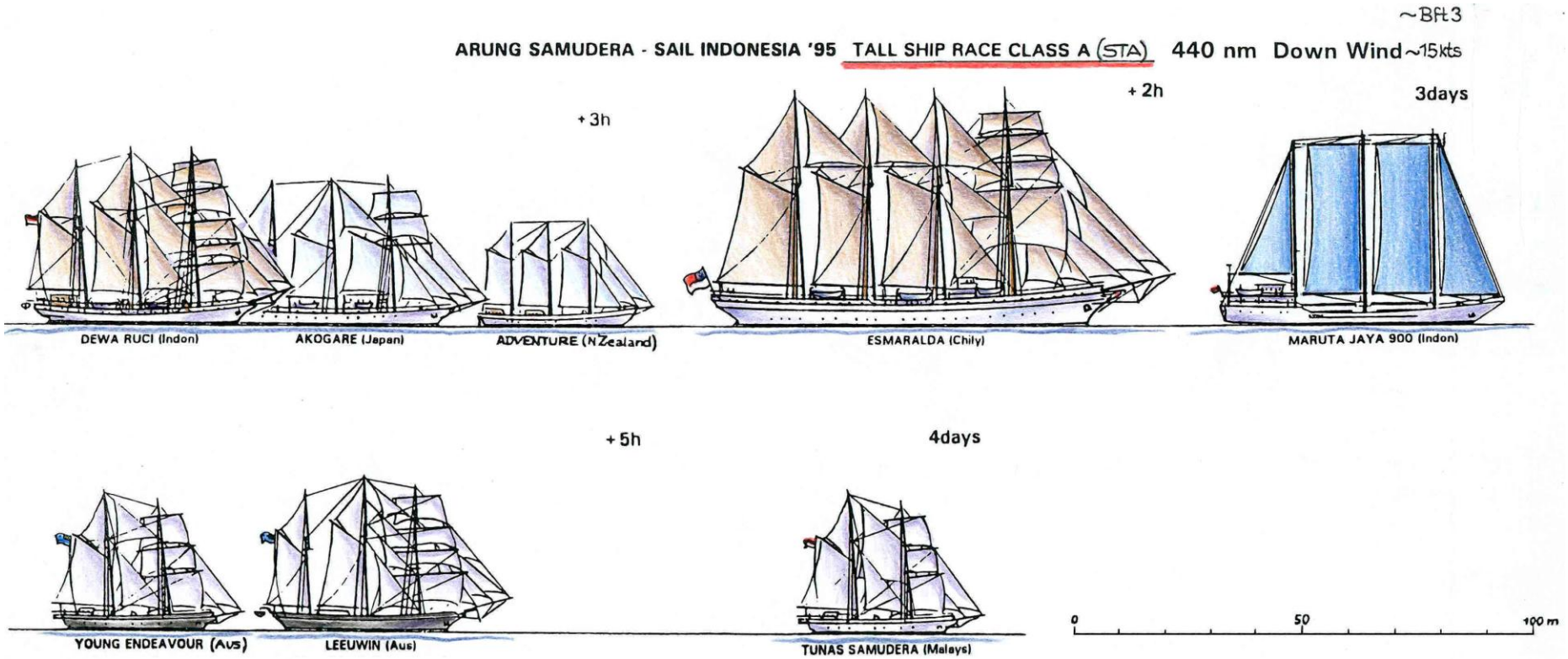


INDOSAIL TRIALS

After extensive functional and structural trials, the Prototype Vessel was monitored during 3 years of trial service across the Jawa- and Sulawesi-Sea.

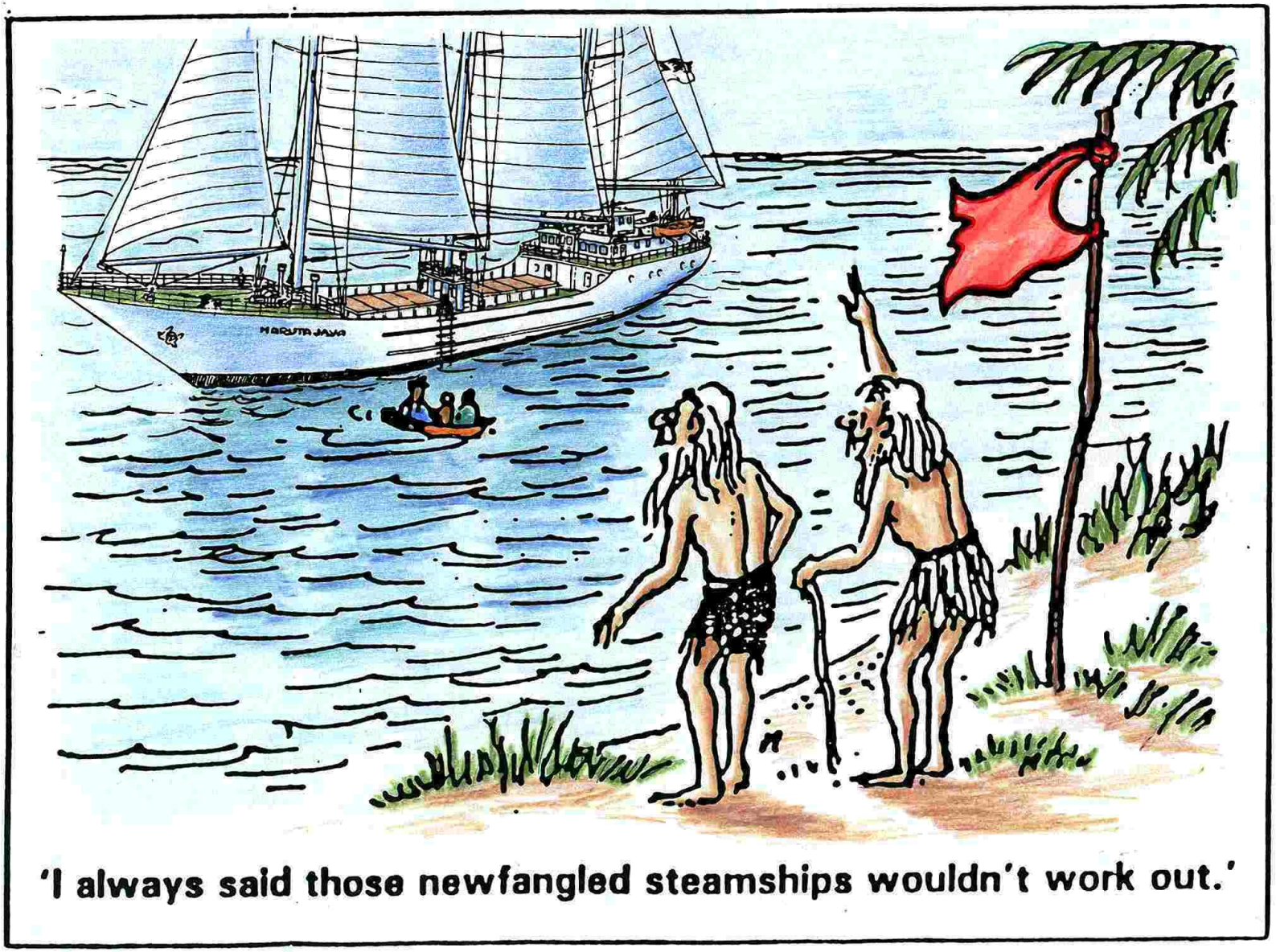
The Performance corresponded well to the Predictions and a professional but non-sailing crew could easily and safely handle the vessel after a few weeks.

3-Masted Prototype Cargo Sailer



In 1995 the INDOSAIL Prototype 'MARUTA JAYA 900' joined the STA Tall Ship Race 'Sail Indonesia'95' in Class A.

She finished as 'First Ship Home' after 440 nm down-wind.



'I always said those newfangled steamships wouldn't work out.'