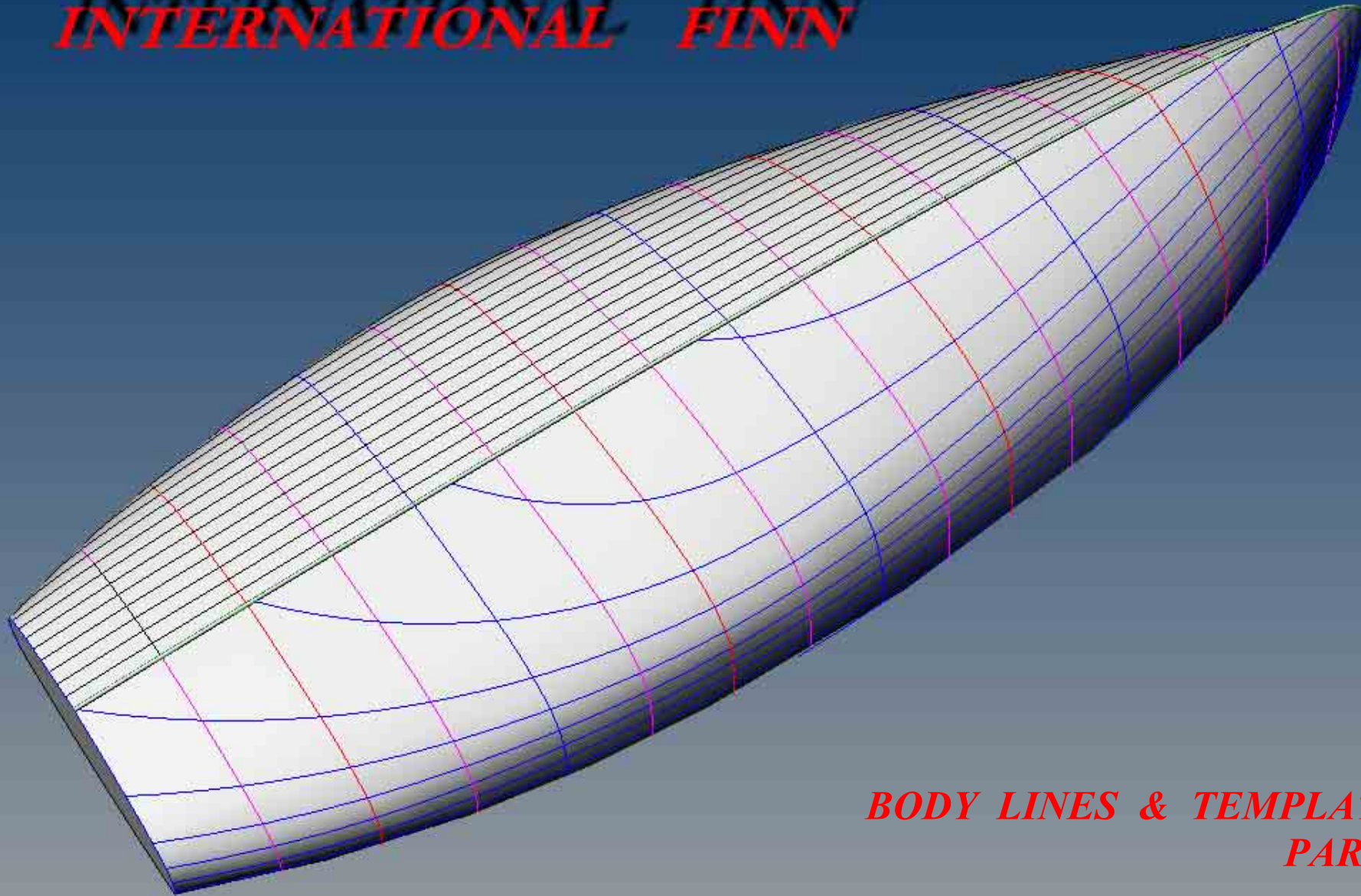


# *INTERNATIONAL FINN*



## *BODY LINES & TEMPLATES PART II*

*Gilbert Lamboley June 2006*

## **PART II**

### **2006 report**

#### **Digital model; Water Lines and Vertical Sections**

## II, 1 Introduction

In Part I, we have been telling how the Templates Lines and thus the Controlled Lines of the Finn (Stations 0-2-4-6-8 and Sheer) had been restored in 2003.

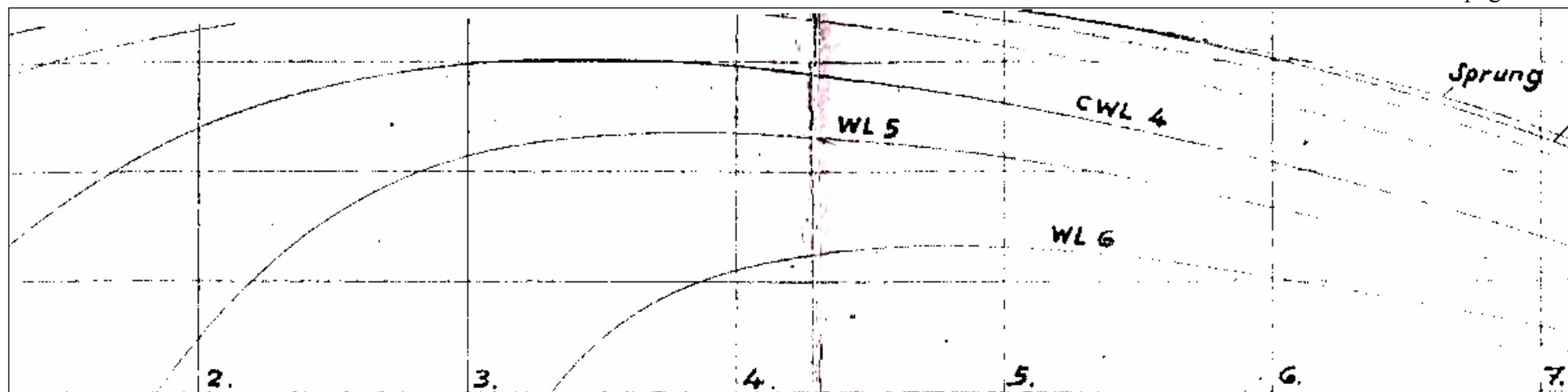
Intermediate stations (1-3-5-7) definition had still to be restored. Easy work if only one print of Finn Lines could have been found back! Since 1964, dozens of prints on stable polyester film had been sent all over the world. Our quest for at least one of them met the silence of a calm sea.

Yet more and more people are asking for those odd numbered stations design. This is how we have been engaged in a patient archaeological restoration.

Remnants of Finn prime ages were, beside the controlled lines:

- Sheets of coordinates, copies of which are delivered beneath,
- An old distorted and faded copy of 1964 drawing which I found when removing my office.

Further on is a report of the work and of its results.



Aufmaßtabelle		Dimensionen in millimetern									
Spanten		0.	1.	2.	3.	4.	5.	6.	7.	8.	9.
<b>Sprung</b>	(Oberk. Seite Deck)	182	185	180	174	157	131	112	80	45	
<b>Schnitt</b>	A		340	452	500	497	435	212			
- " -	B	359	459	519	558	570	558	510	364		
- " -	C	434	495	544	583	604	612	607	554	385	
<b>Kiel</b>		468	516	560	596	624	644	654	647	610	
<b>Sprung</b>	(Oberk. Seite Deck)	445	618	717	754	747	700	618	485	280	
WL 1		451	620	717	754	745	690	603	462	259	
WL 2		450	616	707	745	733	670	575	434	235	
WL 3		379	535	663	717	695	627	520	375	190	
CWL 4			148	487	599	593	519	414	275	124	
WL 5				125	442	473	420	325	206	72	
WL 6						238	260	196	110	13	

Finn Offsets from FinnLog 1. Discrepancies with Blatt Nr 1 (1958) noted.

Stn 4: Buttock C height

Stn 6: Sheer height, Buttock C height

Stn 5: Sheer height

Table of Offsets as valid 1951 to 1959

Stations		0.	1.	2.	3.	4.	5.	6.	7.	8.	9.
Sheer hight	Below baseline	182,	185	180	174	157	135	110	80	45	
Buttock A hight			340	452	500	497	435	212			
Buttock B hight			359	459	519	558	570	558	510	364	
Buttock C hight			434	495	544	583	605	612	599	554	385
Keel hight			468	516	560	596	624	644	654	647	610
Deck width	Half width	445	618	717	754	747	700	618	485	280	
Waterline 1			451	620	717	754	745	690	603	462	259
Waterline 2			450	618	707	745	733	670	575	434	235
Waterline 3			319	535	663	717	695	627	520	375	190
Keel Waterline 4				148	487	599	593	519	414	275	124
Waterline 5					125	442	473	420	325	206	72
Waterline 6							238	260	196	110	13

FINNLOG 1

Table of Body Line Offsets taken from Richard Creagh-Osborne's book, first published 1963.

Discrepancies with Blatt Nr 1 (1958) noted:

Stn 4: Waterlines 5 & 6.

Stn 8: Keel (5 mm)

Stn 6: Buttock C

TABLE OF OFFSETS

DIMENSIONS IN MILLIMETRES

STATION		0	1	2	3	4	5	6	7	8	9
SHEER	FROM BASELINE	182	185	180	174	157	131	112	80	45	
BUTTOCK "A"		340	452	500	497	435	212				
BUTTOCK "B"		359	459	519	558	570	558	510	364		
BUTTOCK "C"		434	495	544	583	604	612	599	554	385	
KEEL		468	516	560	596	624	644	654	647	615	
SHEER	HALF BREADTHS	445	618	717	754	747	700	618	485	280	
WATERLINE 1.		451	620	717	754	745	690	603	462	259	
WATERLINE 2.		450	618	707	745	733	670	575	434	235	
WATERLINE 3.		319	535	663	717	695	627	520	375	190	
WATERLINE 4. (l.w.l.)			148	484	599	593	519	414	275	124	
WATERLINE 5				125	442	469	420	325	206	72	
WATERLINE 6							260	196	110	13	

The table of offsets relating to the International Finn Class drawings.

## II, 2 Back to Controlled Lines definition

In 1974, in order to build a new generation of templates, I had measured sets of coordinates from the basic document of Finn (see Part I). From those sets of points, degree three polynomial lines were interpolated and long files of interpolated points coordinates were issued.

Nowadays, all Computer Aided Design programs have their own interpolating curves joining sets of points; those curves are called “splines”. They are composed of sequential polynomial lines of variable degree. Third degree should be used so that any designer may use simplest programs.

Present definition of interpolated curves is not fully satisfactory, as we shall see further on. Up to now, despite many researches, no mathematical and unique definition of one curve running through an important set of points could be found, as far as we know.

From the circular (second degree) curves used in old drawing offices to digital third degree splines, no major progress has been achieved, precision being set apart.

Beneath are the lines built according to 1974 polynomials and lines built with third degree splines (from Rhinoceros program). Both are interpolating 1974 measured points from Finn basic document (engraved Al alloy sheet)..

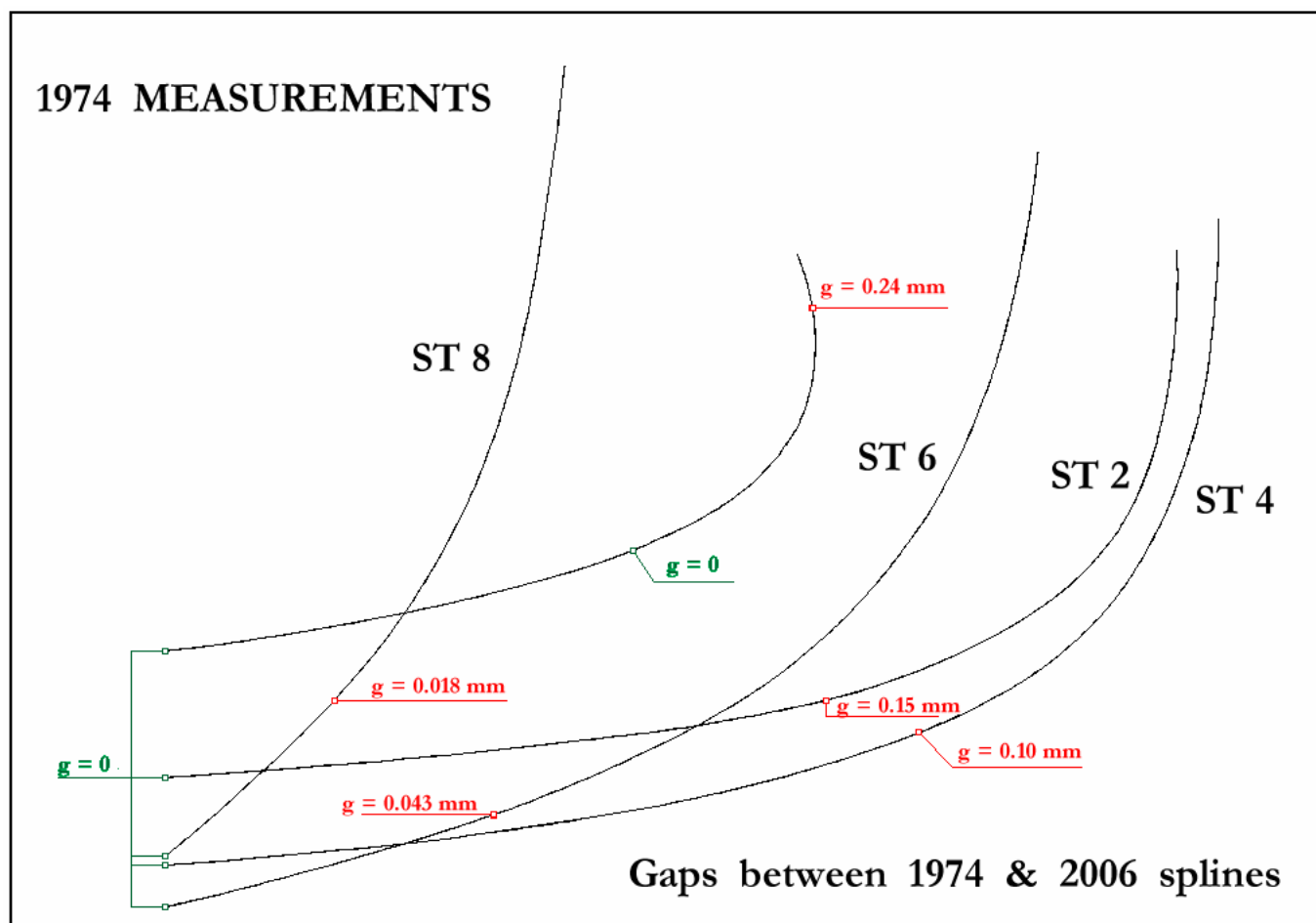


Figure II, 1

Above diagram shows that

- different sorts of “splining” lead to lines which are not significantly different
- it is not necessary to keep dense 2003 sheets of coordinates as regard body lines definition

## II, 3 Setting Keel Line

First job has been to build Keel Line and its extension along Stem.

Keel Line is defined by Finn Rules which state distance from OX axis to flat above Keel Band. Stem Line must comply with existing Template.

Thence Keel Line is actually defined by a line set 6mm aside. Actual Keel Line is deduced from Stations Lines at their lower end as is showed further on. If divergences are weak near transom, they grow up to about 7 mm at Station 8 (see also Part I).

Keel Line must join Stem Line. It has been possible to join those two lines so that they be tangent but alas not with a same curvature. Keel Line could be smoothed, yet running through points defined by Finn Rules. But curvature of Stem Line does not vary smoothly and it cannot be modified because it must conform to Stem Template. A sketch is delivered below.

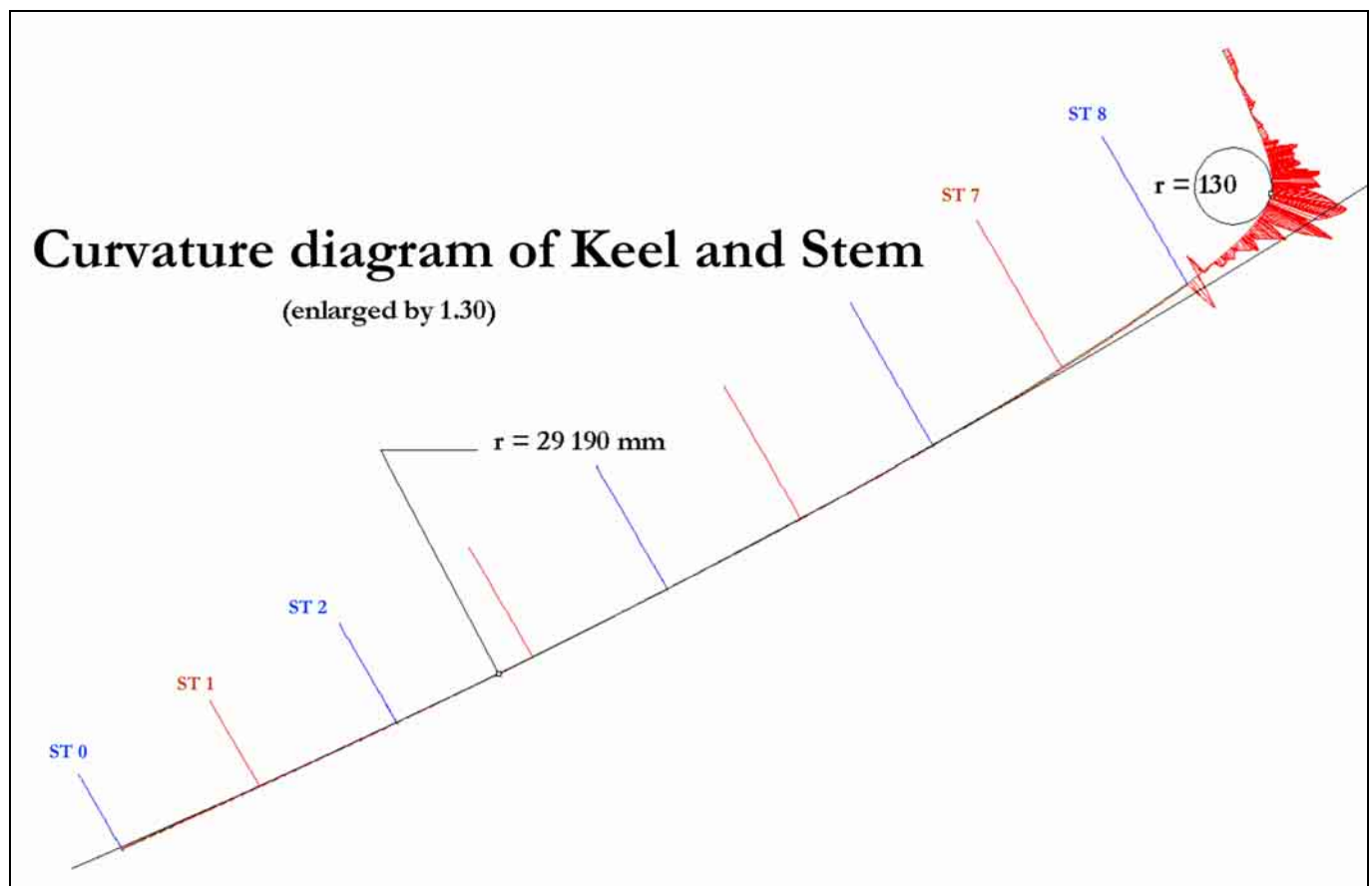


Figure II, 2



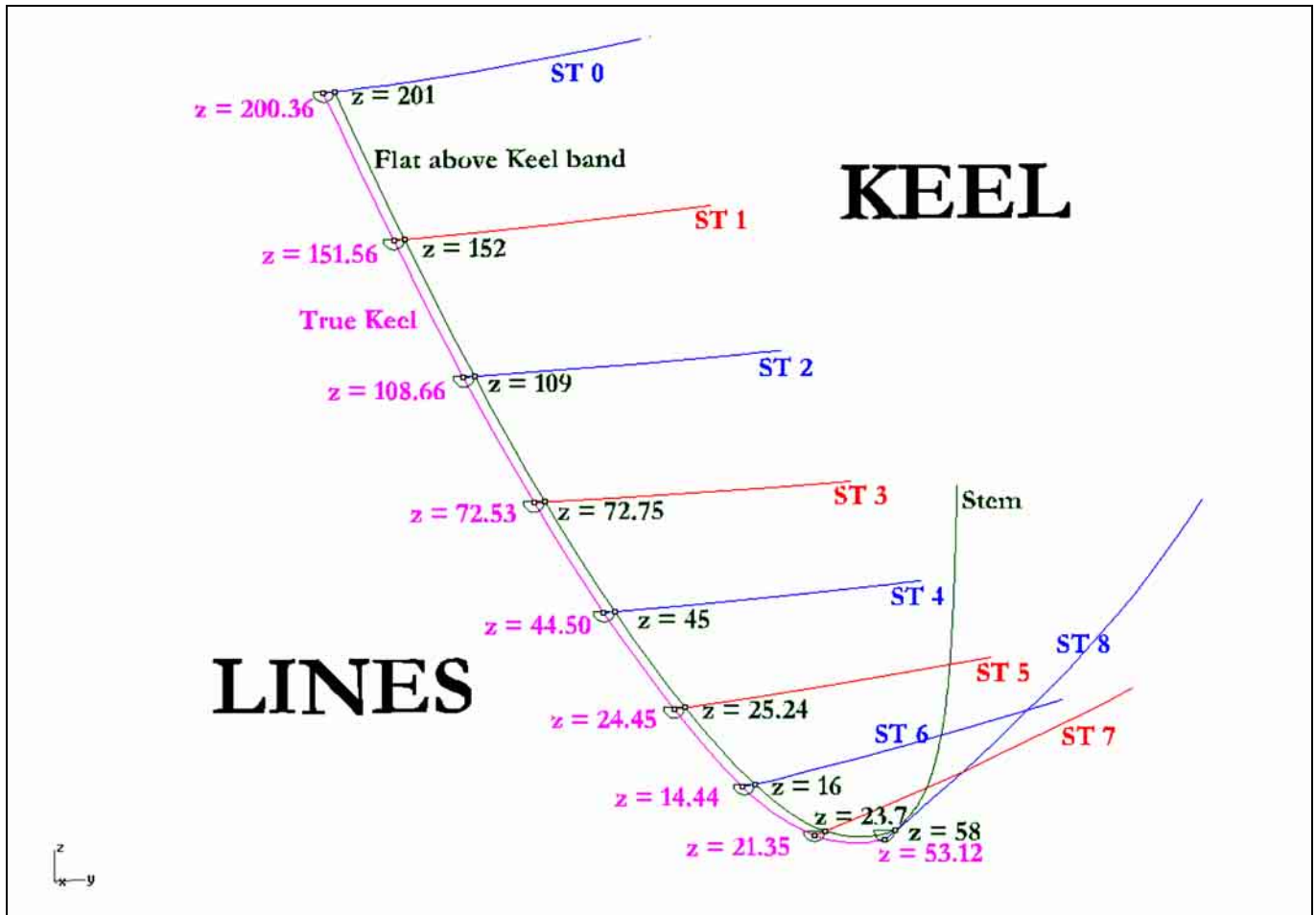


Figure II, 3

## II, 4 Finding Stations 1-3-5-7 lines

That has been a delicate job.

Let us recall (also see Part I):

Sarby's Finn first known data were issued in 1958 by the Swedish National Association; they show on a sheet of coordinates with a precision of 1 mm.

1964 drawings of Finn Stations were achieved with best precision allowed by tools of that time (rules and circular curves). Those drawings were laid out onto a sheet of Aluminium Alloy. They were also copied on "mylar" (polyester) films which were distributed all over the world.

In 1974, I had to provide new sets of templates for IFA. So I measured templates lines coordinates from the Main Aluminium Alloy carving, at about every 25 mm. The aim was to make those templates with a digitally driven tool. From my readings were issued third degree polynomial curves (cubic lines): thus, every template line was defined by a succession of tangent cubic lines. The new templates were checked by a sworn geometrician to be distant by no more than 0.3 mm from the Main Carving along significant parts; that is to say

with the precision of the engraved lines width. Ten sets of templates were made in 1974 and 10 new ones in 1984.

In 2003, new templates were needed. I could issue 1974 template lines from punched tapes records which had been saved. From the templates lines, I could deduce the controlled Stations lines 0, 2,4,6,8 together with Stem line and Rudder line.

The odd Stations lines ST 1, 2,3,5,7 were still to be drawn. As we have been unsuccessful to get back one of the numerous polyester film copies, I have had no other issue than to estimate coordinates from a distorted and faded copy I have found back.

Reading that copy with the help of powerful magnifying lens, I could now and then find the background grid. And what makes the search more valuable, I could find marked points at many lines intersections and also at points corresponding to 1958 table of coordinates. Charles Currey and Richard Creagh Osborne had attempted to draw lines through 1958 points and have never been much away with a few erratic exceptions.

## **II, 5 Consistency of FINN Lines from 1958 to 2006**

Underneath is a comparison between 1958 data and 1974 splines. I wanted to check what would be the divergences before being confident in my measurements.

The similitude is remarkable, some erratic data yet appearing. Those mainly appear along low water lines, which may be explained by the difficulty of reading intersections of lines crossing at weak angles. An exception is found at station 6 for  $y = 600$ . There was obviously a misprint in 1958 hand made document. Others obvious misprints could be easily corrected; they are marked with a “\*”

Further on is a drawing (figure II, 4) showing divergences between lines issued from 1958 data and 1974 or 2006 measurements. Gaps between Lines (measured perpendicular to lines) are much smaller and appear to be local. A major divergence (about 5 mm narrower) has been revealed at lower part of Station 8. Elsewhere, it appears that Lines drawn in 1964 are close to 1958 data.

A delicate and fair job have done Charles Currey and Richard Creagh Osborne !

### Comparing 1958 offsets and 2006 readings

1958 data in black; 2003-2006 data in red; divergences x 10 in red. Coordinates are related to original frame of reference. Unit is millimetre

Station		0		1		2		3		4		5		6		7		8		
Sheer	z (original frame)	-182	4	-185	5	-180	0	-174	1	-157	1	-135*	1	-110*	2	-80	3	-45	8	
		-182.4		-184.5		180		-174.1		-156.9		-134.9		-109.8		-80.3		-45.2		
y = 600				-340	5	-452	0	-500**	0	-497	2	-435	7	-212	40					
				-339.5		-452		-500		-496.8		-434.3		-216.0						
y = 400			-359	13	-459	1	-519	1	-558	3	-570	1	-558	1	-510	1	-364	4		
			-360.3		-458.9		-518.9		-557.7		-569.9		-558.1		-510.1		-363.6			
y = 200			-434	4	-495	4	-544	3	-583	3	-604	2	-612	0	-599*	1	-554	10	-385	2
			-434.4		-494.6		-543.7		-582.7		-604.2		-612.0		598.9		-553.0		-385.2	
Keel			-468	3	-516	2	-560		-596	4	-624	0	-644	2	-654	3	-647	3	-610	28
			-468.3		-516.2				-595.6		-624.0		-644.2		-653.7		-647.3		-612.8	
Sheer	Half breadth y	445	0	618	1	717	0	754	7	747	0	700	5	618	2	485	3	280	3	
		445.0		618.1		717.0		754.7		747.0		699.5		617.8		484.7		279.7		
WL1 z = -200			451	2	620	2	717	7	754	4	745	3	690	3	603	4	462	10	259	1
			451.2		620.2		717.7		754.4		744.7		689.7		-603.4		461.0		258.9	
WL2 z = -300			450	8	618	0	707	9	745	12	733	8	670	6	575	4	434	7	235	1
			450.8		618.0		707.9		746.2		732.2		669.4		574.6		433.3		235.1	
WL3 z = -400			319	18	535	3	663	2	717	5	695	9	627	3	520	2	375	9	190	19
			320.8		535.3		663.2		717.5		694.1		626.7		520.2		374.1		191.9	
WL4 z = -500				148	32	487	26	600**	0	593	5	519	7	414	18	275	4	124	14	
				151.2		484.4		600.0		593.5		518.3		415.8		274.4		121.4		
WL5 z = -550					125	33	442	15	473	4	420	4	325	3	206	10	72	2		
					128.3		440.5		472.6		419.6		324.7		205.0		71.8			
WL6 z = -600									238	52	260	6	196	5	110	7	13	25		
									232.8		259.4		196.5		109.3		15.5			

\* Finn log data. \*\*obvious misprint (ST3: 600,-500 at y=600 and 599,-500 at WL4); 600,-500 retained

## II, 6 Retaining coordinates and Body Lines

Let us remind that Stations Lines had to be slightly shifted up and down in order to comply with Finn Rules (see Part I).

Lines controlled by Templates must comply with those Templates. Thus the coordinates I have been using are derived from Templates coordinates with as many points as were delivered by 1974 splines.

Odd numbered stations (1-3-5-7) coordinates have been read from the 1964 copy I found back.

Hence the table below comparing final coordinates with 1958 ones.

When lines are too close to axes directions, greater divergences appear; so we are delivering a drawing of lines together with actual gaps between them (Figure II, 4). It appears that Lines issued from Templates engraving diverge by up to 0.9 mm (Station 2) from my copy of 1964 film drawing. I also have applied their corresponding Templates to 1964 Lines; divergences appear to be much smaller despite film distortion; that shows that my present 2006 measurements are pessimistic; but my poor eyes got weeping so much (same taste as sea waves) that I have stopped trying to be more performing.

The aim has been to find back odd numbered Stations. Green figures ensure that using 1964 document has not been too bad although wearying.

Full size Lines are delivered in attached “Body-Temp” files (see paragraph II,9). They are also shown on figure II,5; writings have been lost but that picture bears enlargement.

## II, 7 Digitized Finn hull

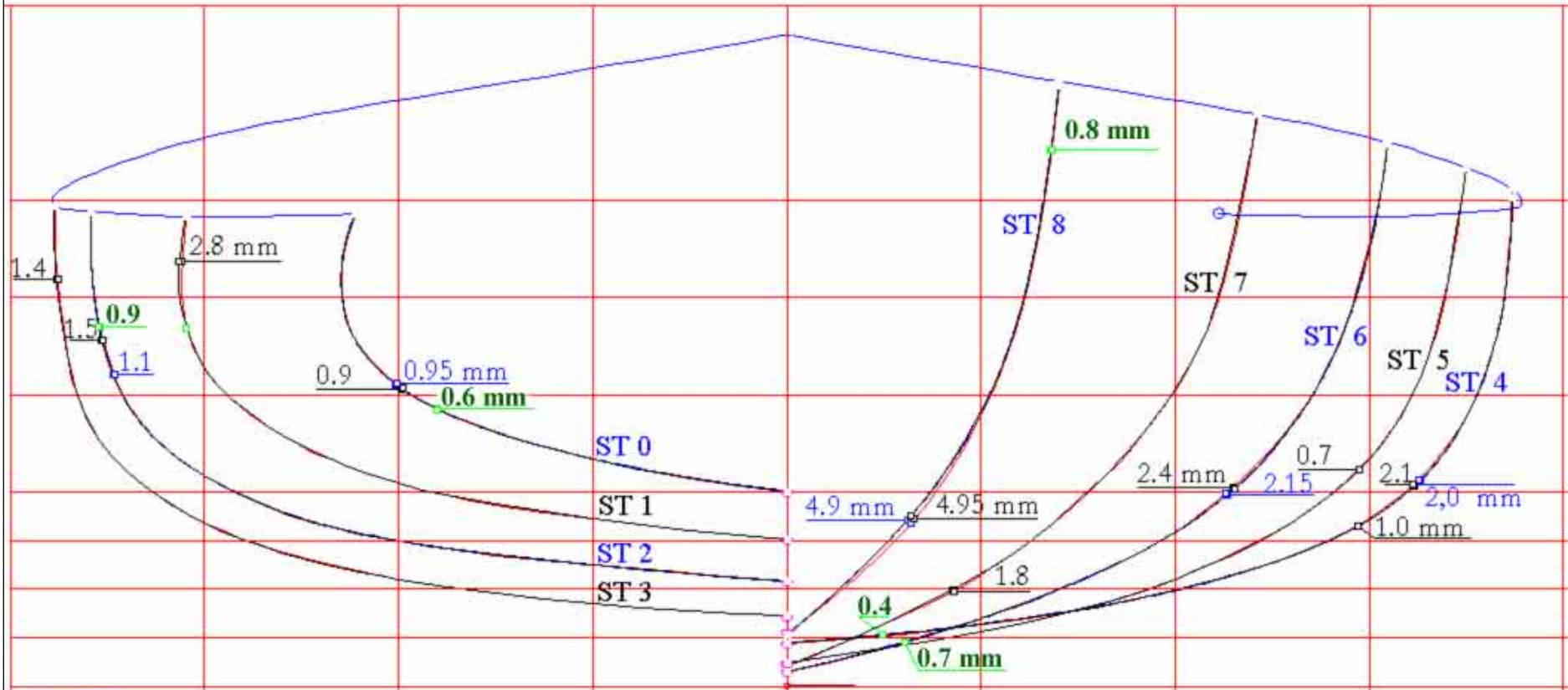
From its Body Lines, a hull surface could be meshed, delivering shape of cover page. Lights and shades do not reveal any bump.

## Comparing 1958 offsets and 2003-2006 retained coordinates

1958 data in black; 2003-2006 data in red; divergences x 10 in red.      Coordinates are related to original frame of reference.      Unit is millimetre.

Station		0		1		2		3		4		5		6		7		8			
Sheer	z (original frame)	-182	2	-185	3	-180	3	-174	5	-157	1	-135*	3	-110*	11	-80	1	-45	11		
		-182.25		-185.32		-179.72		-174.45		-156.87		-134.73		-108.93		-80.13		-46.07			
y = 600				-340	3	-452	2	-500**	4	-497	2	-435	10	-212	60						
				-340.32		-451.83		-500.35		-496.79		-433.98		-217.98							
y = 400				-359	13	-459	7	-519	3	-558	0	-570	1	-558	1	-510	0	-364	6		
				360.27		-459.72		-518.74		-558.05		-570.09		-557.93		-509.97		-363.43			
y = 200				-434	2	-495	4	-544	4	-583	0	-604	3	-612	2	-599*	2	-554	12	-385	16
				-434.24		-495.42		-543.59		-583.05		-604.32		-611.83		-598.78		-552.83		-386.55	
Keel				-468	5	-516	5	-560	5	-596	3	-624	5	-644	0	-654	15	-647	22	-610	5
					-467.48		-516.48		-559.48		-595.73		-623.48		-643.24		-652.48		-644.78		-610.48
Sheer	Half breadth y	445	2	618	1	717	0	754	7	747	0	700	5	618	4	485	3	280	2		
				618.10		716.99		754.70		747.00		699.50		618.37		484.70		280.18			
WL1 z = -200				451	2	620	17	717	5	754	12	745	7	690	7	603	9	462	51	259	2
				451.22		621.68		717.50		755.17		745.74		689.67		603.94		467.13		259.23	
WL2 z = -300				450	5	618	3	707	6	745	13	733	2	670	7	575	0	434	8	235	4
				450.48		618.25		707.61		746.25		733.21		669.35		575.01		433.23		235.41	
WL3 z = -400				319	14	535	16	663	6	717	7	695	1	627	4	520	2	375	10	190	29
				320.44		536.57		663.60		717.69		695.07		626.59		520.25		373.97		192.88	
WL4 z = -500						148	152	487	9	600**	7	593	16	519	0	414	17	275	8	124	21
						163.60		486.10		600.72		594.63		519.03		415.71		274.20		121.94	
WL5 z = -550							125	57	442	2	473	2	420	2	325	11	206	14	72	16	
							130.66		442.22		473.19		420.16		323.88		204.63		73.61		
WL6 z = -600											238	58	260	14	196	3	110	11	13	57	
											232.77		258.64		196.31		108.95		18.56		

Body Lines according to { 1974 Official Templates  
 1964 drawing on polyester Film  
 1958 sheet of data



blue gaps between 2006 splines and splines issued from 1958 table  
 black gaps between 1964 drawing and 1958 table  
 green gaps between 2006 splines and 1964 drawing

Figure II,4

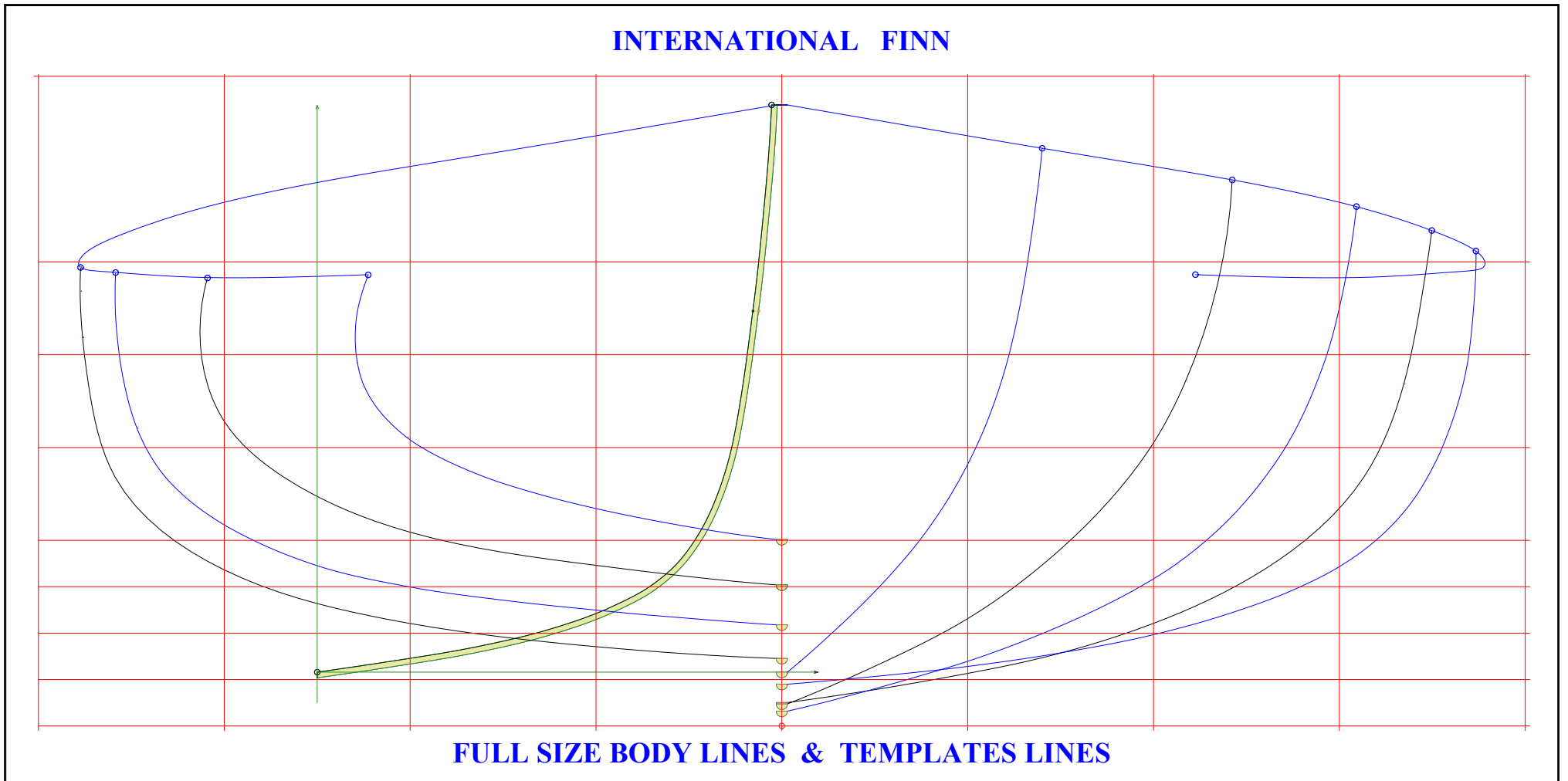


Figure II, 5

## II, 8 Body Lines Curvatures

A problem is enlightened by mathematical progress. With nowadays electronic programs, it is possible to check variations of curvature along lines. My endeavour was to restore Finn basic documents. But those old curves show unpleasant variations of curvature which water flow cannot like, because increasing the added mass of water trailed by boat.

Drawing gentle curves which keep as close as possible with the original and successful design is a major work. With present state of art, there is no mathematical technique which allows drawing lines the derivatives of which be continuous, thus inducing gentle variations of curvature.

The only way is to work step by step, finding fair lines and then fair hull surface. And remind that a set of fair lines does not necessarily lead to a fair surface.

In figure II, 6, I show curvatures variations of stations. They look quite unpleasant and yet, when following with thumb the templates which they are issued from, they look quite smooth. And that thumb is quite a sensitive tool. Indeed if the lines are continuous, actually their derivatives (hence their curvatures) are not

In figure II, 7, I have chosen the most unpleasant looking Station 0 and I have tried to smooth its curvature variations.

The faired curve (on right) is only different from original one by a maximal gap of 0.72 mm. It is widely complying with Finn Rules And it would be possible to do still better by first swelling original line a little.

But that is builders' job. Mine is over.



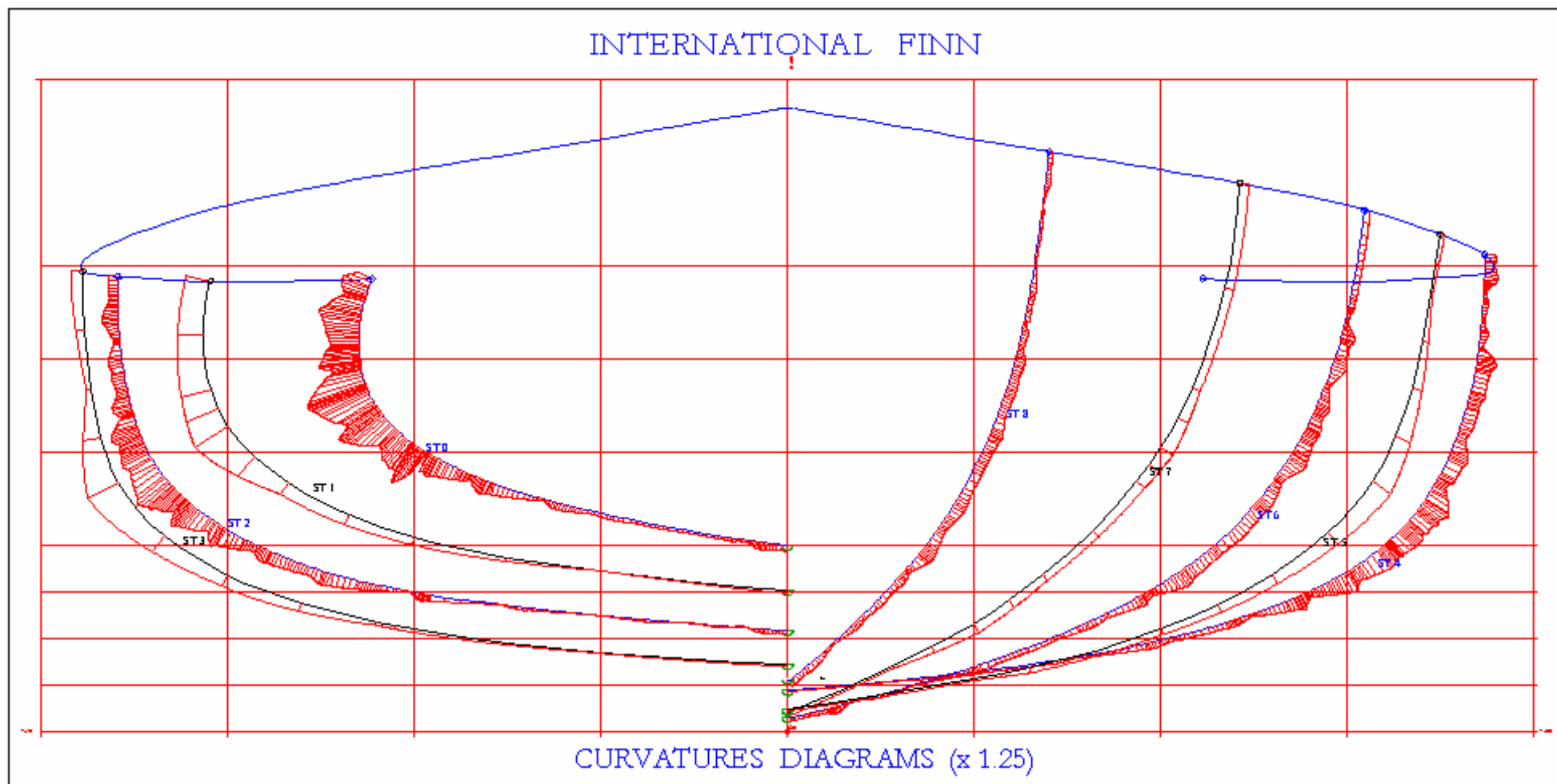
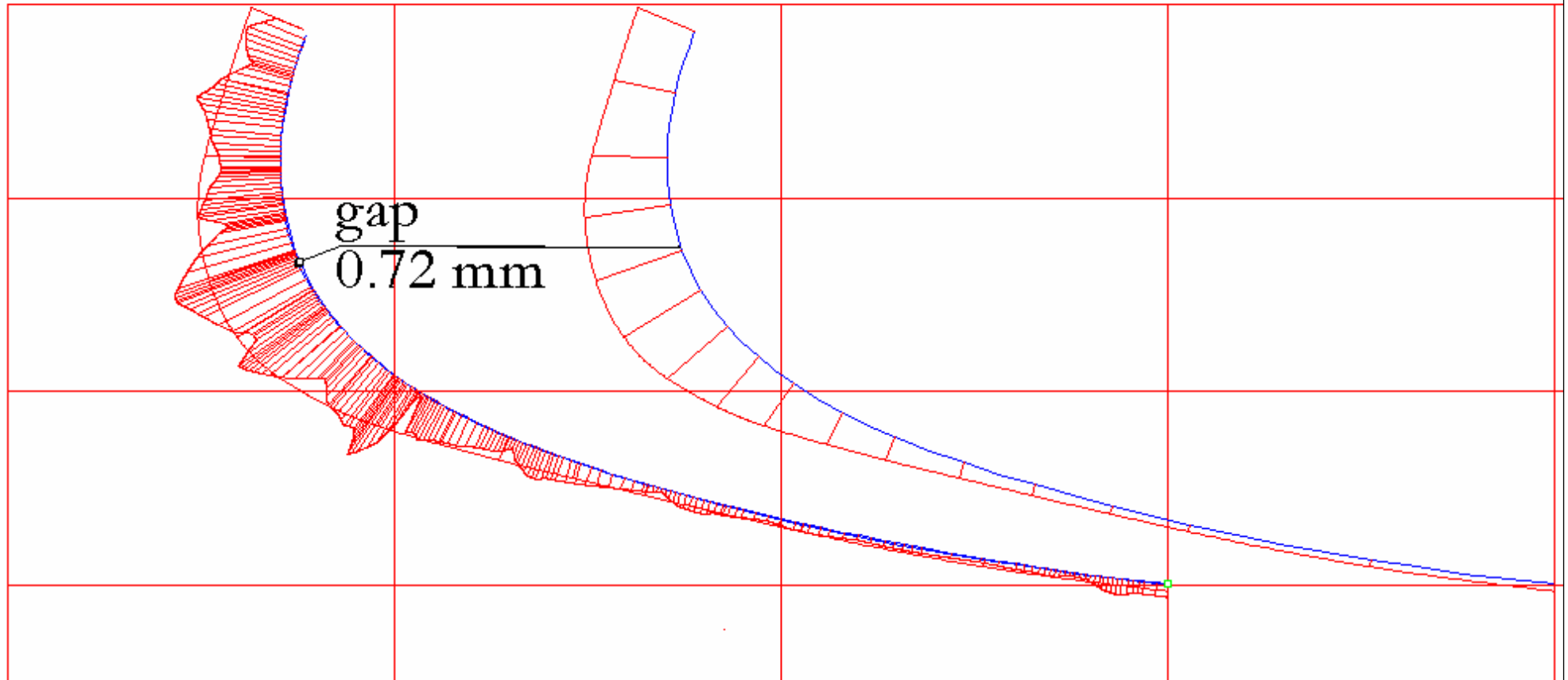


Figure II, 6

# INTERNATIONAL FINN



FAIRING STATION 0

Figure II, 7

## II, 9 Body Lines Table of Coordinates

**Download attached documents !**

**[finn-Body-coord.xls](#)**

This is an “Excel” spread sheet delivering coordinates of water lines every 50 mm and coordinates of vertical sections every 100 mm athwart ship.

**[finn-Body-coord.pdf](#)**

This a “.pdf” file delivering sets of close coordinates along Stations, Keel, Stem and Rudder. Coordinates of Stations **0-2-4-6-8** are derived from 1974 official set of International Finn Templates which were digitized for CNC carving. Coordinates of Stations **1-3-5-7** are derived from original documents of the Finn.

**[FinnOverAllLines.txt](#)**

This text document delivers all sets of coordinates in a crude list which may be digested by any electronic program. It even delivers coordinates every 250 mm along ship as were taken from Finn Hull digitized model

**[Finn Hull digitized model](#)**

This is the “Rhinoceros” model of the original Finn, for you to play with, to smooth it and to get the magic Finn (of course inside “building” tolerances).

## **II, 10 Full size documents**

Full size drawings of both Station lines and Templates ones may be obtained by printing underneath electronic files; they are waiting you for downloading. You may also only look at them from your computer screen or get under scaled prints from your personal printer (unless you own one of those huge professional printers).

### **[finn-Body-Temp.3dm](#)**

That drawing is the master one; it has been achieved using “Rhinoceros” program and the “.3dm” is a special Rhinoceros one.

### **[finn-Body-Temp.dwg](#)**

This is a translation of Rhinoceros file which may be read by any compatible “AutoCAD” program. It enables to print full size Body and Templates Lines using any professional printer. It may also be read on any PC screen and printed in reduced size by any PC printer.

### **[finn-Body-Temp.pdf](#)**

This is an “Acrobat” version of previous ones with same possibilities.