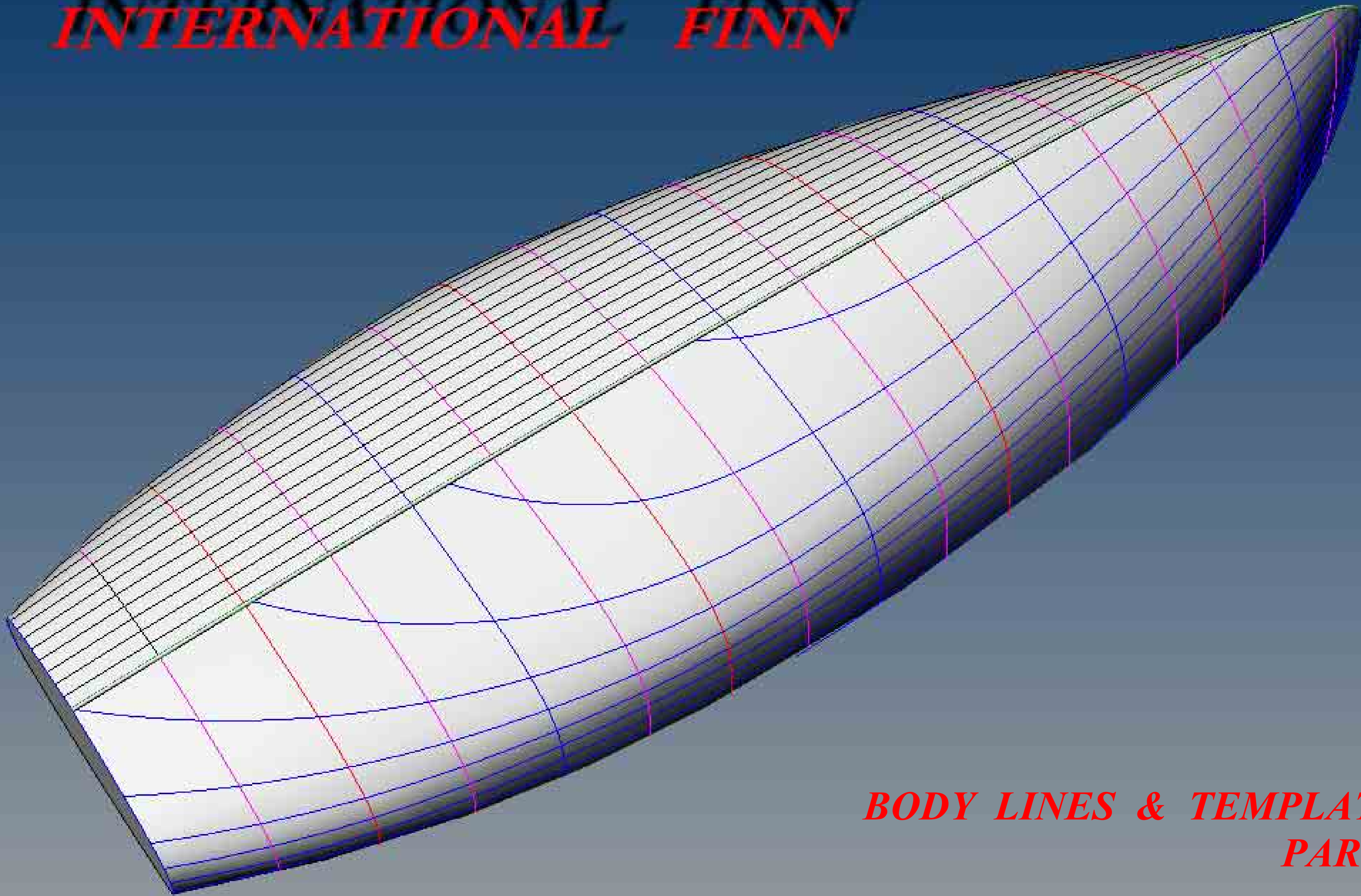
INTERNATIONAL FINN



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.

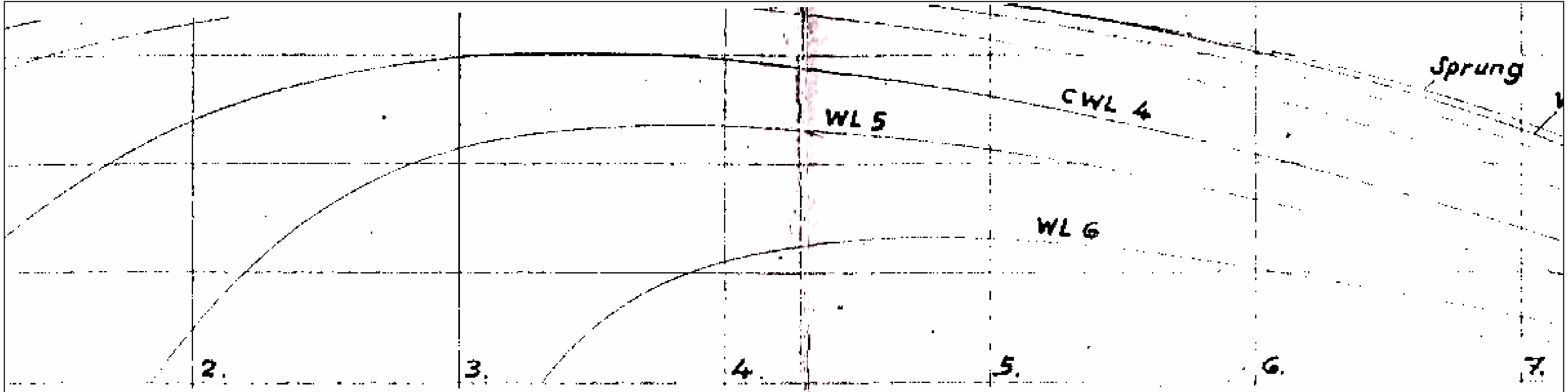
Intermediate stations (1-3-5-7) definition had still to be restored. Easy work if only one print of Finn Lines could have been found back! Since 1964, dozens of prints on stable polyester film had been sent all over the world. Our quest for at least one of them met the silence of a calm sea.

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.
Sprung (Oberk. Seite Deck)	von der Basis	182	185	180	174	157	131	112	80	45	
Schnitt A	von der Basis		340	452	500	497	435	212			
— " — B	von der Basis	359	459	519	558	570	558	510	364		
— " — C	von der Basis	434	495	544	583	604	612	601	554	385	
Kiel	von der Basis	468	516	560	596	624	644	654	647	610	
Sprung (Oberk. Seite Deck)	halbe Breiten	445	618	717	754	747	700	618	485	280	
WL 1	halbe Breiten	451	620	717	754	745	690	603	462	259	
WL 2	halbe Breiten	450	616	707	745	733	670	575	434	235	
WL 3	halbe Breiten	319	535	663	717	695	627	520	375	190	
CWL 4	halbe Breiten		146	487	599	593	519	414	275	124	
WL 5	halbe Breiten			125	442	473	420	325	206	72	
WL 6	halbe Breiten					238	260	196	110	13	

Scanned from Internationale "Finn" Klasse Linienplan 1:10, Blatt Nr 1. Berichtigt bis 1.II.1958

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

Stn 4: Buttock C height

Stn 5: Sheer height

Stn 6: Sheer height, Buttock C 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"	FROM BASELINE	—	340	452	500	497	435	212			
BUTTOCK "B"	FROM BASELINE	354	459	519	558	570	558	510	364		
BUTTOCK "C"	FROM BASELINE	434	495	544	583	604	612	599	554	385	
KEEL	FROM BASELINE	468	516	560	596	624	644	654	647	615	
SHEER	HALF BREADTHS	445	618	717	754	747	700	618	485	280	
WATERLINE 1.	HALF BREADTHS	451	620	717	754	745	690	603	462	259	
WATERLINE 2.	HALF BREADTHS	450	618	707	745	733	670	575	434	235	
WATERLINE 3.	HALF BREADTHS	319	535	663	717	695	627	520	375	190	
WATERLINE 4. (l.w.l)	HALF BREADTHS		148	484	599	593	519	414	275	124	
WATERLINE 5	HALF BREADTHS			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)..

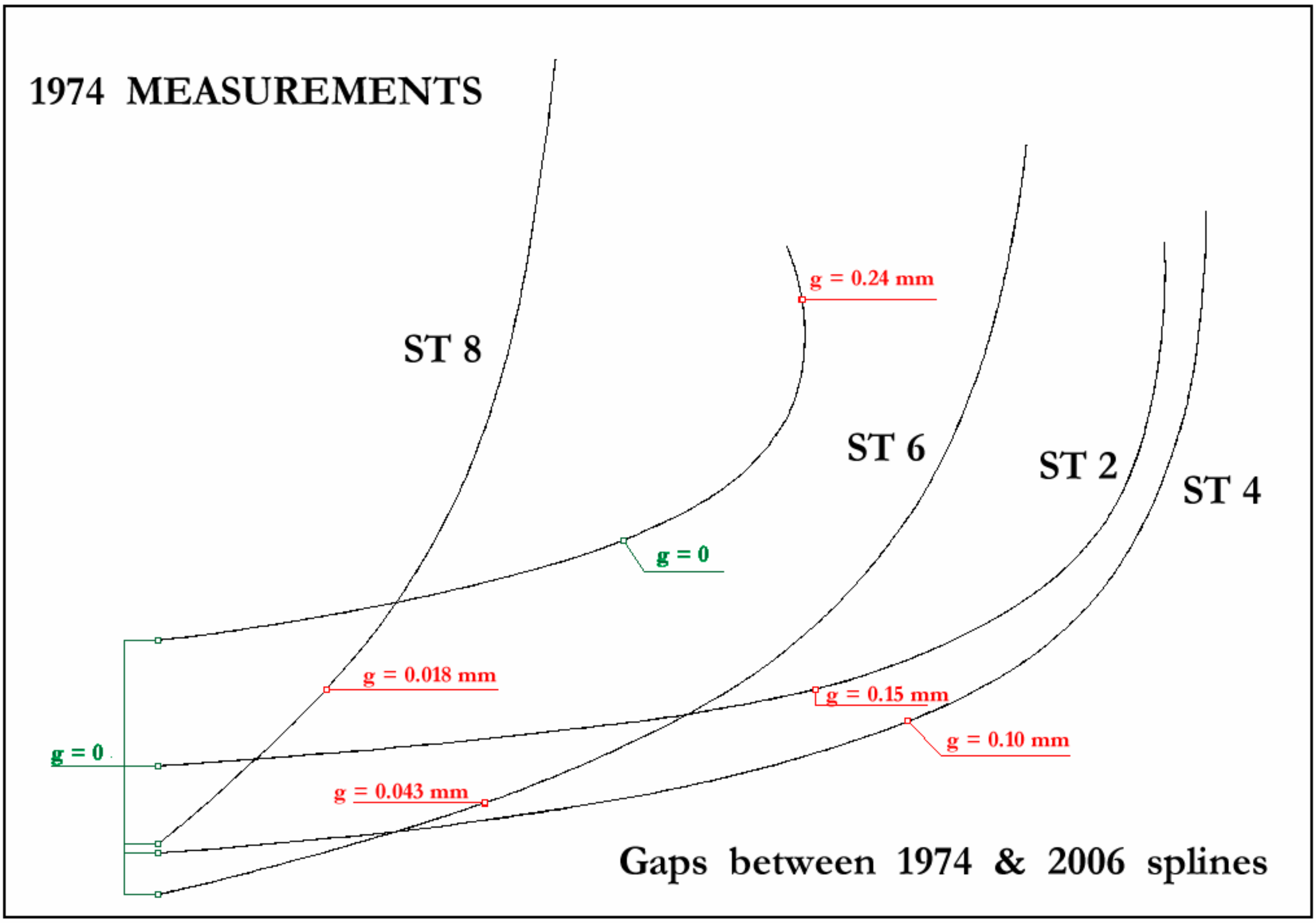


Figure II, 1

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.

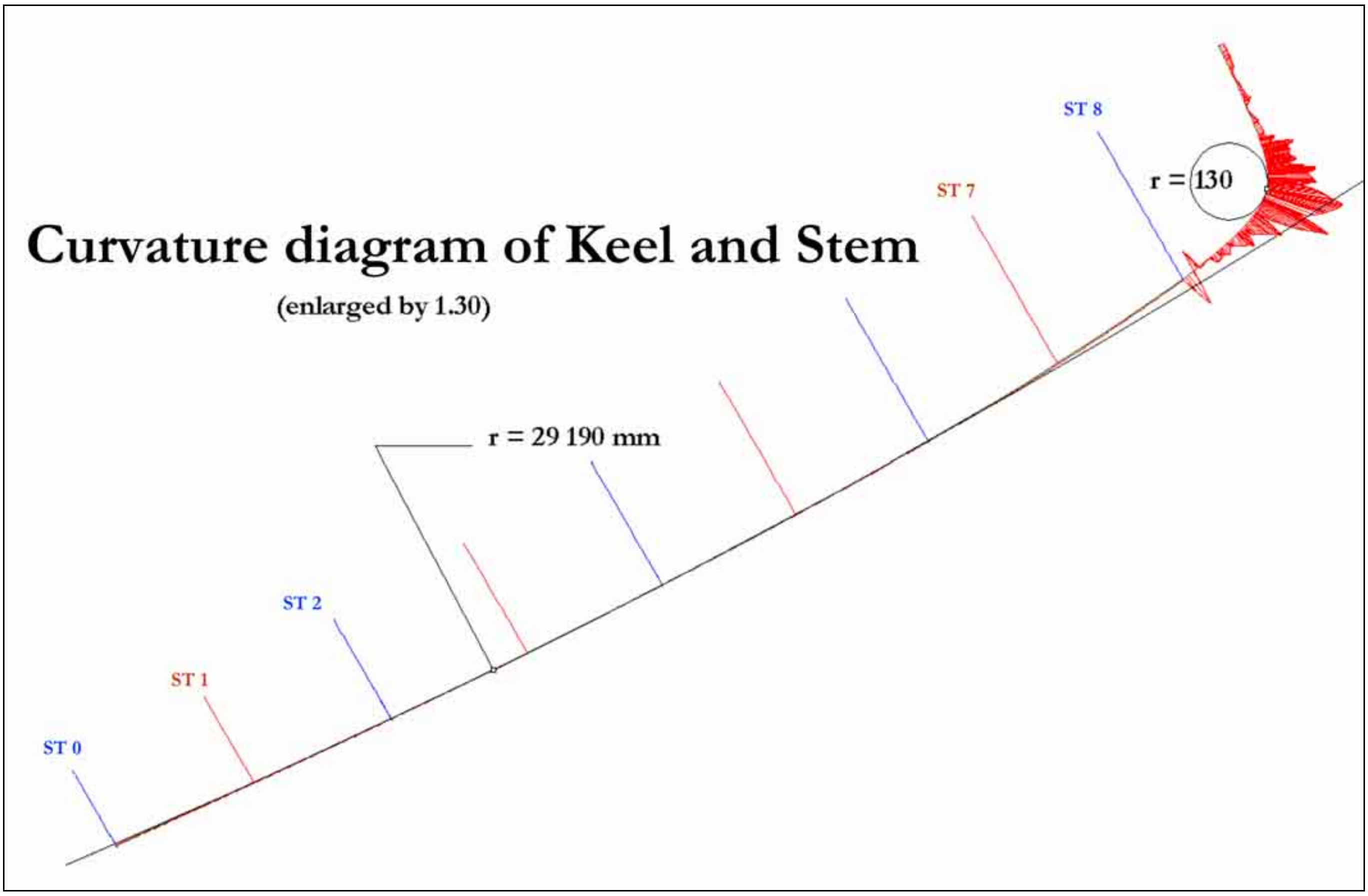


Figure II, 2

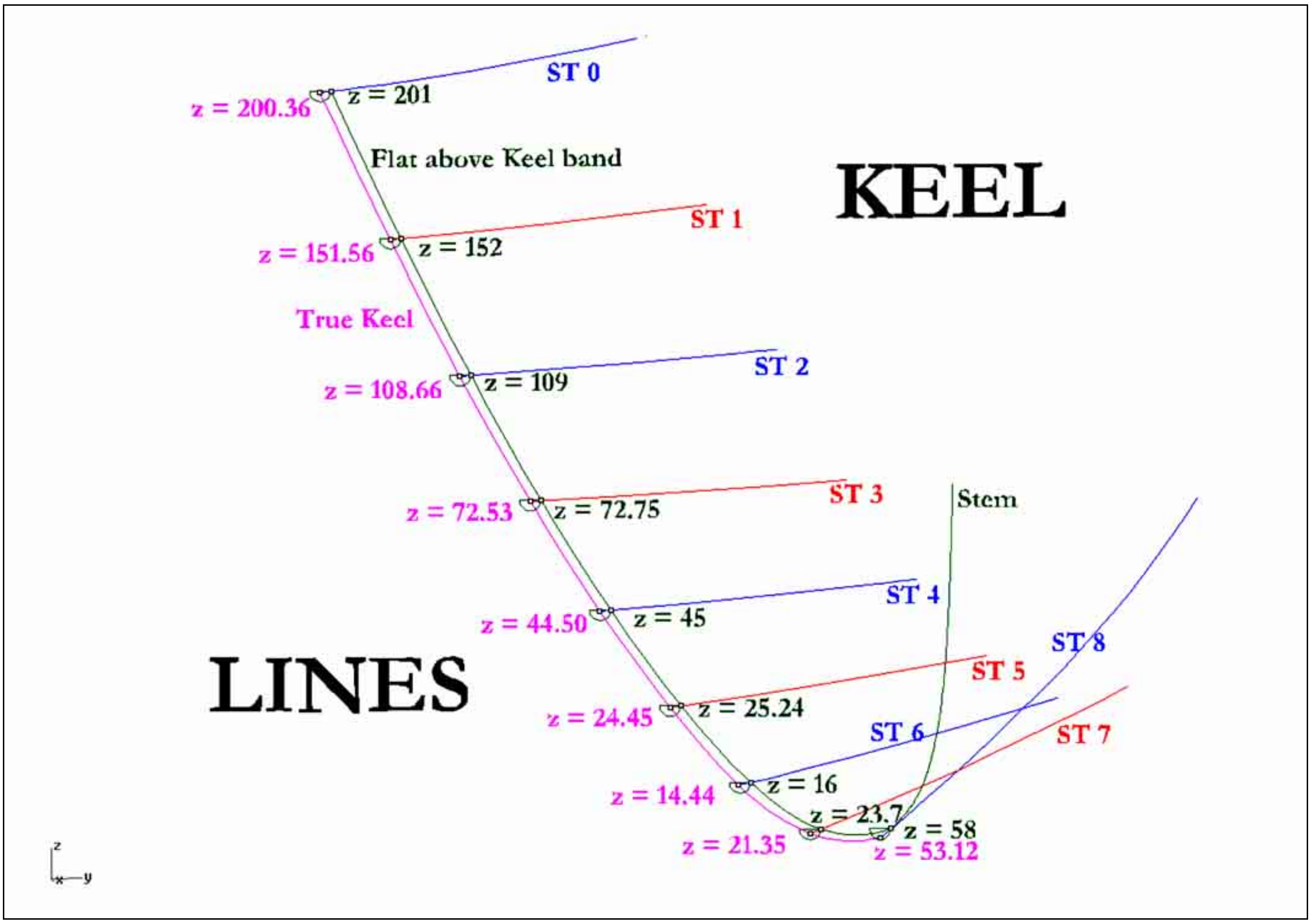


Figure II, 3

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

* 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 -182.25	2	-185 -185.32	3	-180 -179.72	3	-174 -174.45	5	-157 -156.87	1	-135* -134.73	3	-110* -108.93	11	-80 -80.13	1	-45 -46.07	11
y = 600	z (original frame)			-340 -340.32	3	-452 -451.83	2	-500** -500.35	4	-497 -496.79	2	-435 -433.98	10	-212 -217.98	60				
y = 400	z (original frame)	-359 360.27	13	-459 -459.72	7	-519 -518.74	3	-558 -558.05	0	-570 -570.09	1	-558 -557.93	1	-510 -509.97	0	-364 -363.43	6		
y = 200	z (original frame)	-434 -434.24	2	-495 -495.42	4	-544 -543.59	4	-583 -583.05	0	-604 -604.32	3	-612 -611.83	2	-599* -598.78	2	-554 -552.83	12	-385 -386.55	16
Keel	z (original frame)	-468 -467.48	5	-516 -516.48	5	-560 -559.48	5	-596 -595.73	3	-624 -623.48	5	-644 -643.24	0	-654 -652.48	15	-647 -644.78	22	-610 -610.48	5
Sheer	Half breadth y	445 444.81	2	618 618.10	1	717 716.99	0	754 754.70	7	747 747.00	0	700 699.50	5	618 618.37	4	485 484.70	3	280 280.18	2
WL1 z = -200	Half breadth y	451 451.22	2	620 621.68	17	717 717.50	5	754 755.17	12	745 745.74	7	690 689.67	7	603 603.94	9	462 467.13	51	259 259.23	2
WL2 z = -300	Half breadth y	450 450.48	5	618 618.25	3	707 707.61	6	745 746.25	13	733 733.21	2	670 669.35	7	575 575.01	0	434 433.23	8	235 235.41	4
WL3 z = -400	Half breadth y	319 320.44	14	535 536.57	16	663 663.60	6	717 717.69	7	695 695.07	1	627 626.59	4	520 520.25	2	375 373.97	10	190 192.88	29
WL4 z = -500	Half breadth y			148 163.60	152	487 486.10	9	600** 600.72	7	593 594.63	16	519 519.03	0	414 415.71	17	275 274.20	8	124 121.94	21
WL5 z = -550	Half breadth y					125 130.66	57	442 442.22	2	473 473.19	2	420 420.16	2	325 323.88	11	206 204.63	14	72 73.61	16
WL6 z = -600	Half breadth y									238 232.77	58	260 258.64	14	196 196.31	3	110 108.95	11	13 18.56	57

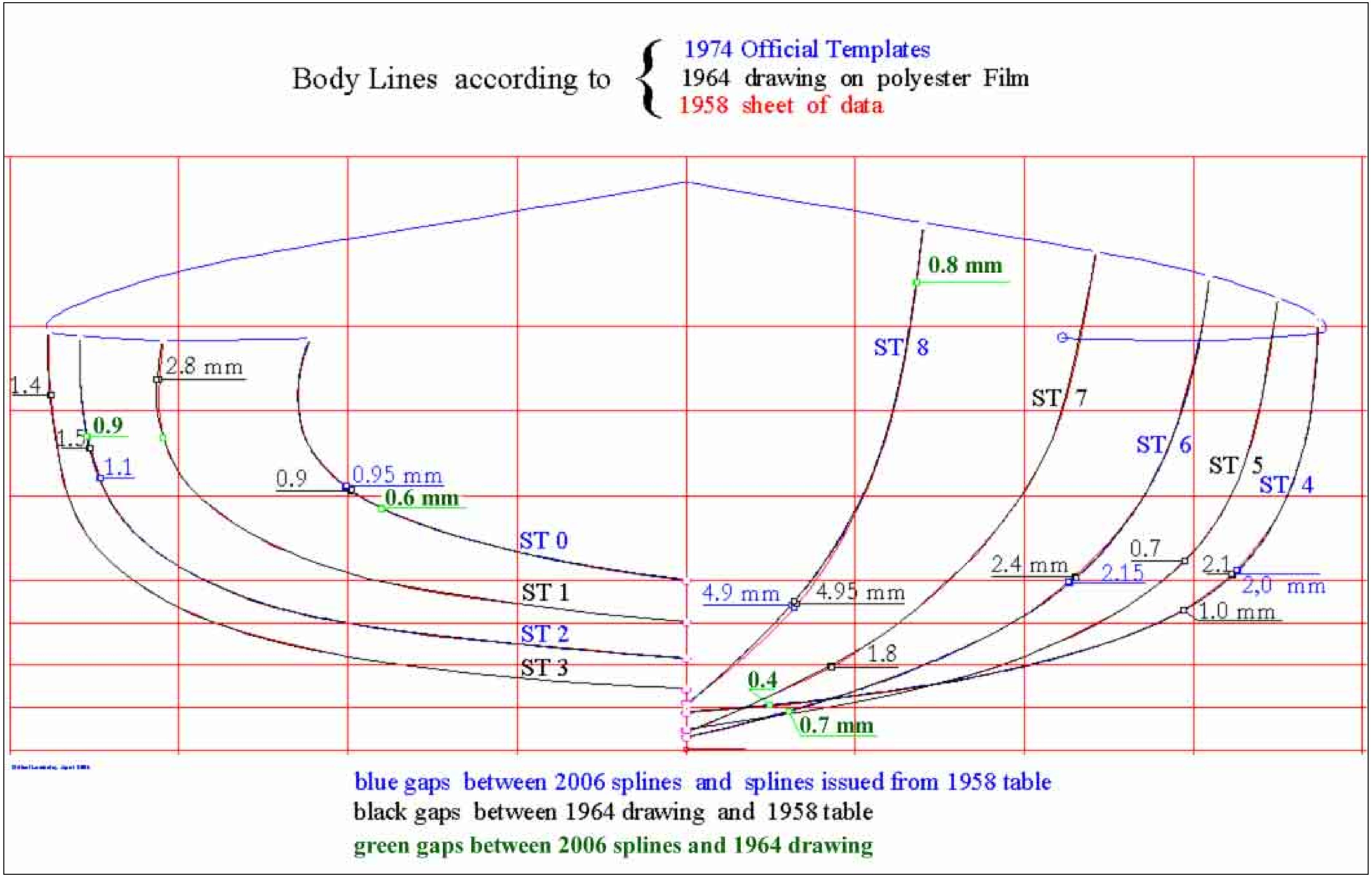
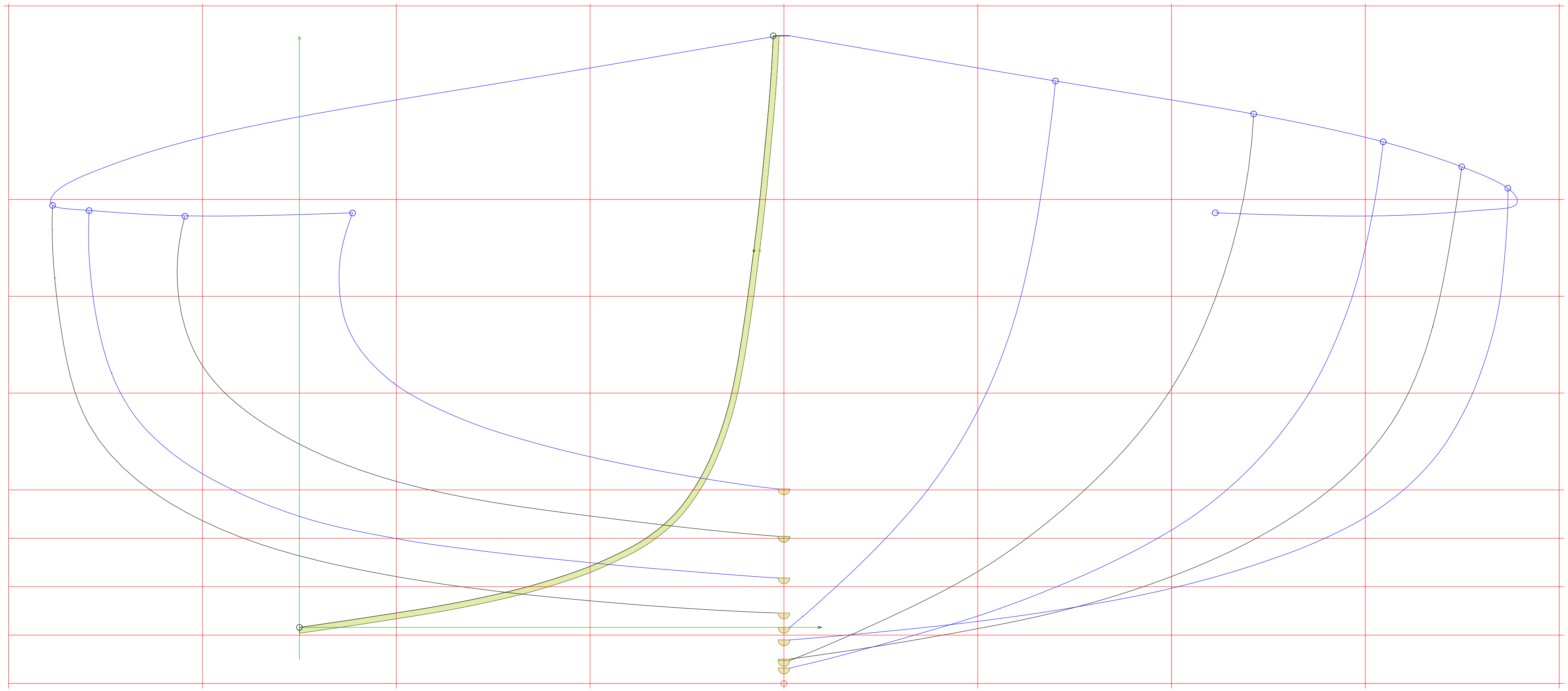

Body Lines according to
1974 Official Templates
1964 drawing on polyester Film
1958 sheet of data
1.4
1.5
0.9
1.1
2.8 mm
0.9
0.95 mm
0.6 mm
ST 0
ST 1
ST 2
ST 3
4.9 mm
4.95 mm
0.4
0.7 mm
1.8
ST 8
0.8 mm
ST 7
ST 6
ST 5
ST 4
2.4 mm
2.15
0.7
2.1
2,0 mm
1.0 mm
blue gaps between 2006 splines and splines issued from 1958 table
black gaps between 1964 drawing and 1958 table
green gaps between 2006 splines and 1964 drawing

Figure II,4

INTERNATIONAL FINN



FULL SIZE BODY LINES & TEMPLATES LINES

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 derivates 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 derivates (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.

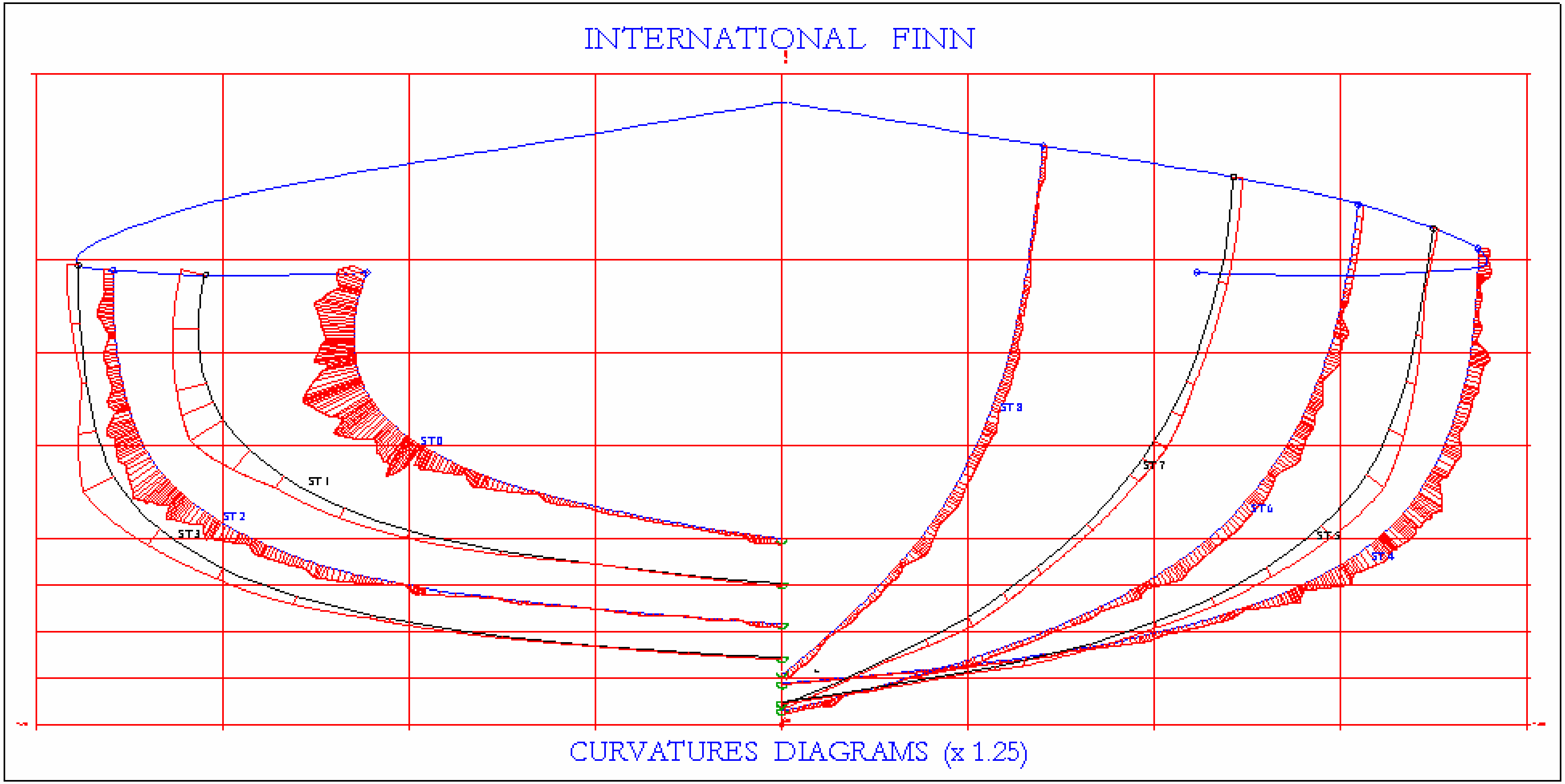

INTERNATIONAL FINN
ST 0
ST 1
ST 2
ST 3
ST 4
ST 5
ST 6
ST 7
ST 8
CURVATURES DIAGRAMS (x 1.25)

Figure II, 6

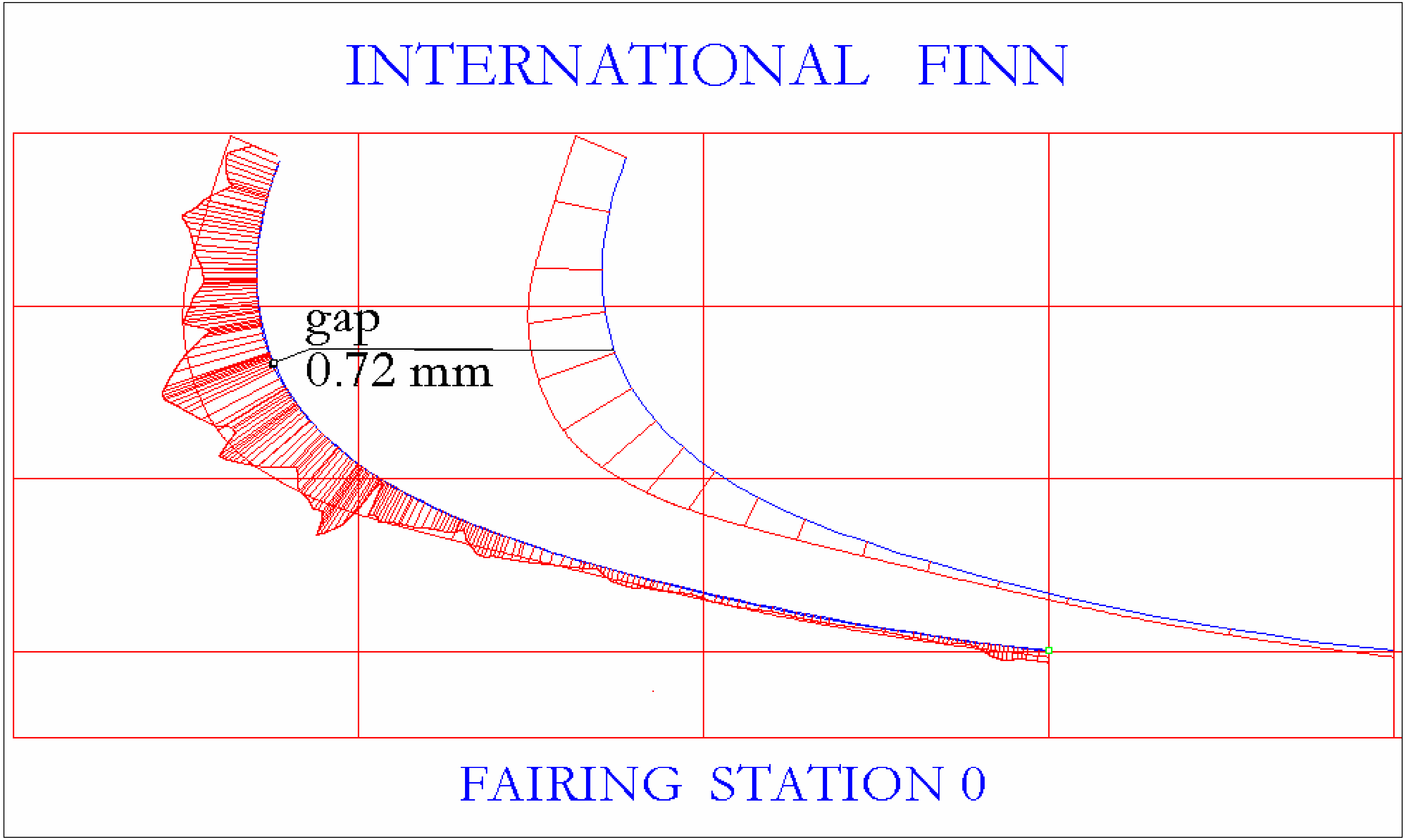


Figure II, 7

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.