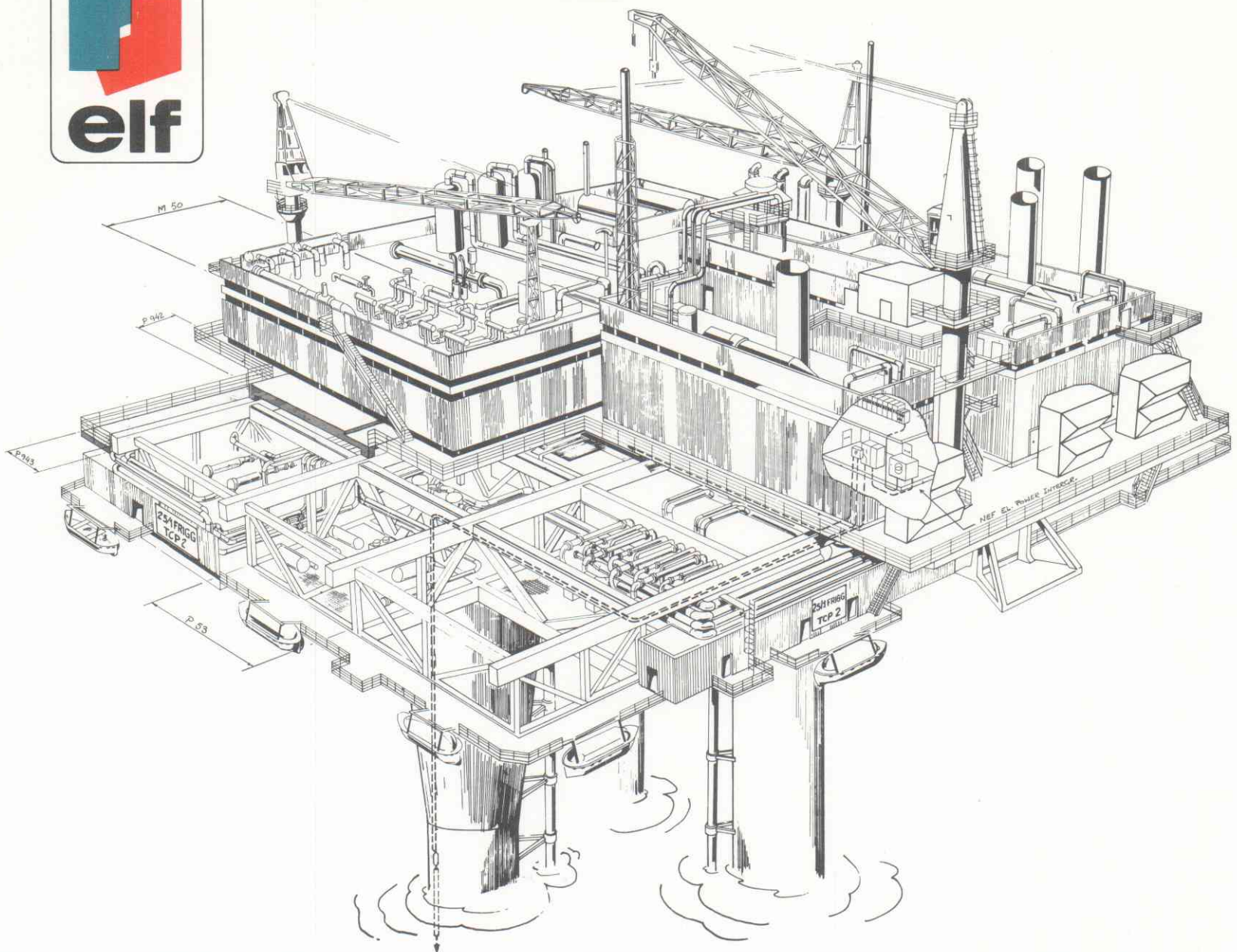




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FRIGG FIELD — TCP2 EXTENSION

FINAL REPORT

VOLUME 3

COST

STAVANGER

FEBRUARY 1984

TCP-2 EXTENSION FINAL REPORT

V O L U M E III

COST

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1 GENERAL INTRODUCTION

1.1 SUMMARY

The Overall Cost of the TCP-2 Extension project in current value is 318.872 KNOK.

The first cost estimate in 1981 value was 643 MNOK whereas the final cost in 1981 value is 259.284 KNOK.

The project started in Stavanger in November 1980. Prior to that the Basic Engineering and Preparation of Engineering Tender Documents were worked out in Paris.

The major part of the Engineering work was carried out in 1981, the Fabrication of the modules started in March 1982 and lasted until April 1983.

The modules were lifted onto TCP-2 by the end of May 1983 and the Commissioning was completed in October.

The production of North East Frigg started in the beginning of December 1983.

1.2 OVERALL PROJECT PLAN

The Overall Project Plan made prior to project start and the latest revised Overall Project Plans are shown hereafter.

The overall project life time from the start of the Engineering in Stavanger until Start Up was 36 months.

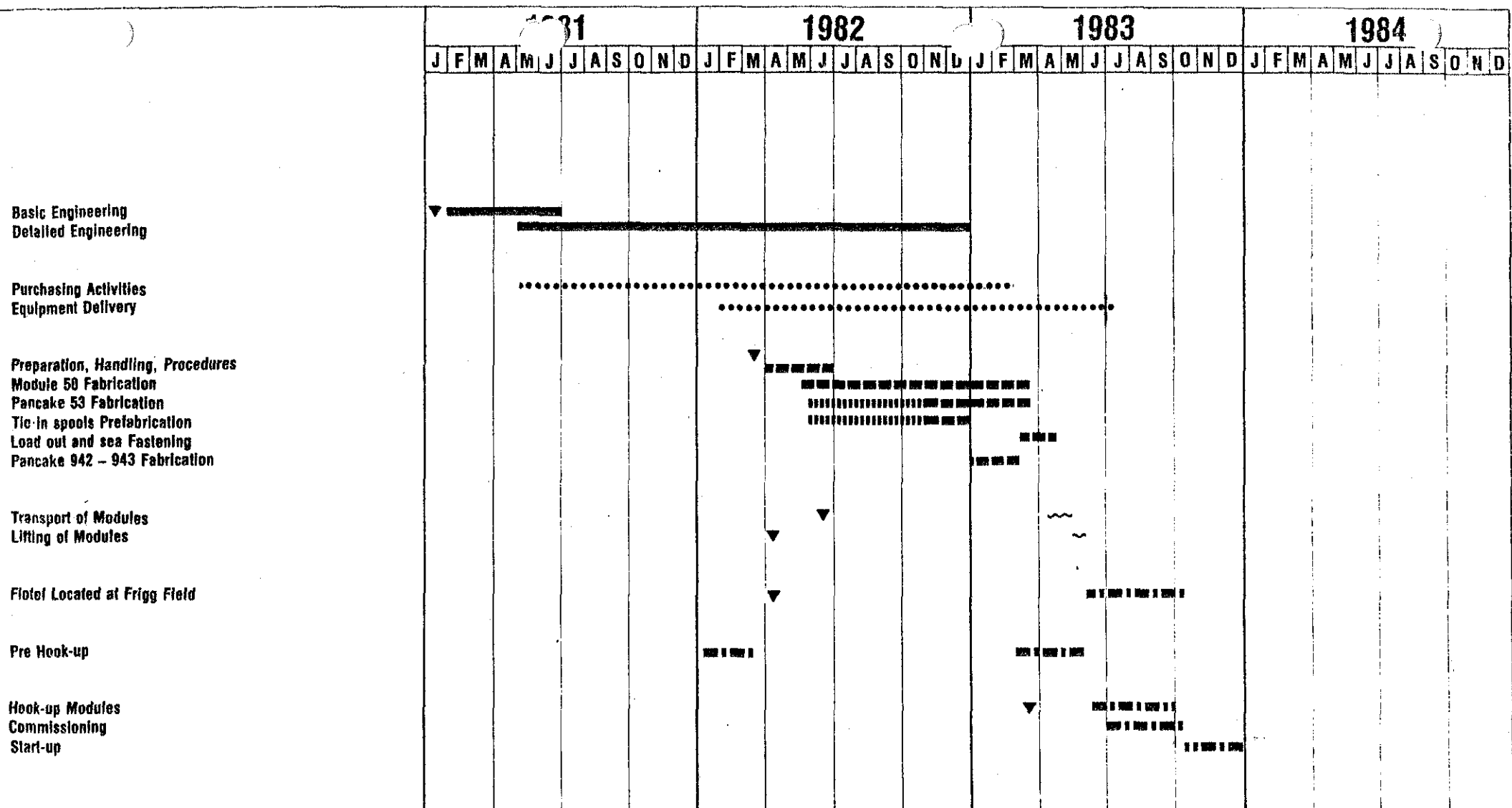
There were no major changes to the original Master Schedule during the course of the project.

The preparation of the Basic Engineering Studies and Engineering Tender Documents started in Paris in the beginning of 1980. The Project team moved to Stavanger in 1980.

The major part of the Engineering works were carried out in 1981, the Fabrication of the modules started in March 1982 and was completed in April 1983.

The modules were lifted onto TCP-2 by the end of May 1983 and the Commissioning was completed in October. The production of North East Frigg started in the beginning of December 1983.

The Actual Overall Project Schedule is shown in Figure 1.1, and the Original Master Schedule worked out in 1980 is shown in Figure 1.2.



LEGEND

	ENGINEERING		CONTRACT AWARD
	PROCUREMENT		
	CONSTRUCTION		
	TRANSPORT LIFTING		
	HOOK-UP WORKS		
	NOT CONTINUOUS WORK		

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PROGRAM

TCP 2 EXTENSION

OVERALL PROJECT SCHEDULE

PHASE I

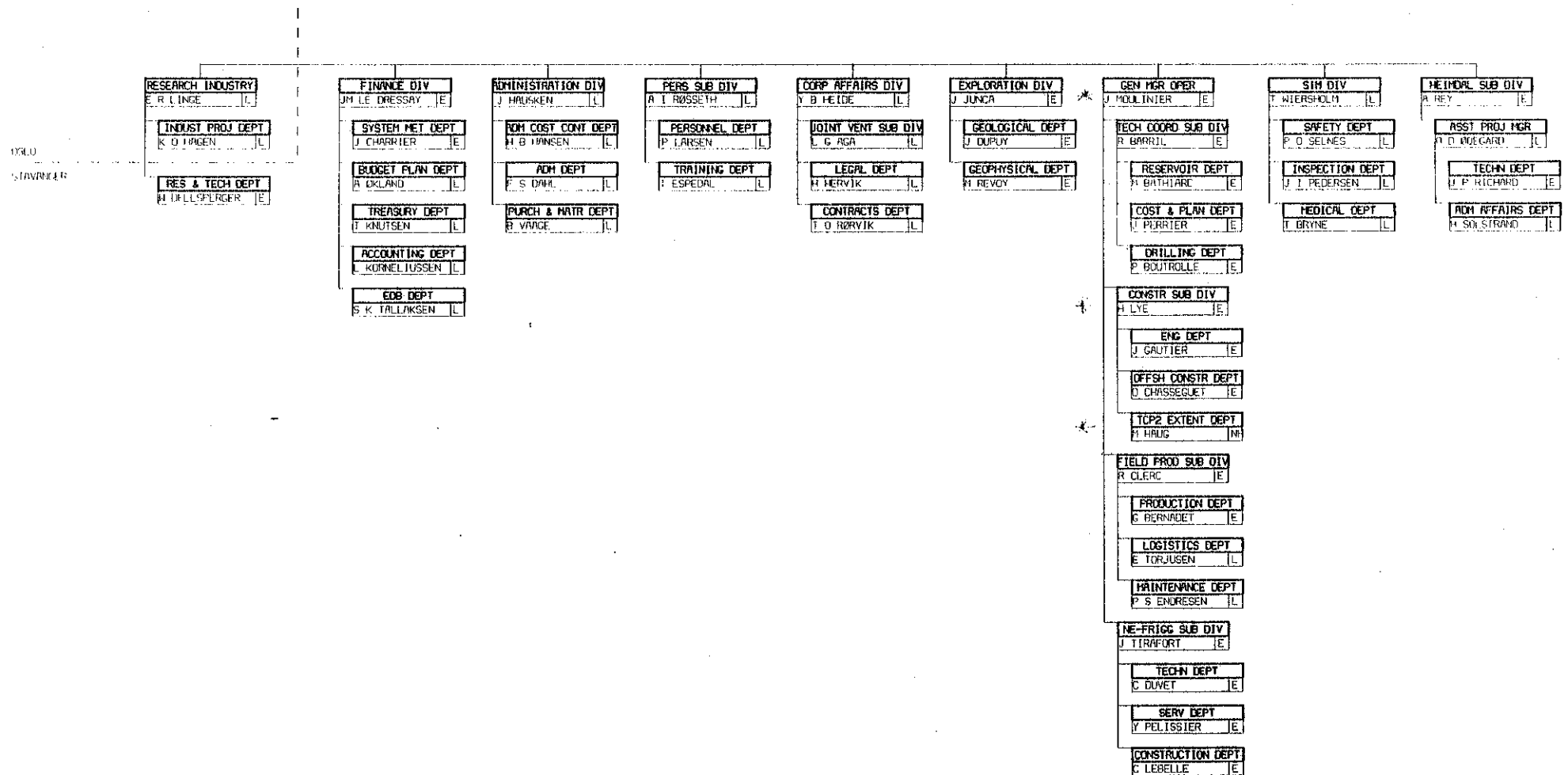
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FIGURE 1.1

1.3 ORGANIZATION WITHIN EAN

The TCP-2 Extension project was a task force organization nominated as a department within the Construction Sub Division.

The position of the Project Organization in the overall company organization is shown on Figure 1.3.



1.4 MAIN CONTRACTS

The following major contract have been awarded:

CONTRACT NO.	COMPANY	MNOK VALUE OF CONTRACT	SCOPE OF SERVICE
F.087	Sofresid Norge A/S	25	Engineering and procurement services
S.818	Det norske Veritas	4	- Design review - General assistance
F.125	Ponticelli Freres	35	Yard construction M50, P53, P942, P943
F.176	Noble Denton & Ass. Norge	0.2	Warranty survey
F.177	Neptun Transport & Marine Services A.B.	3	Transportation of modules
F.139	K/S Heerema Seaway A/S	19	- Lifting engineering - Cleaning TCP2 - Lifting operations
F.142	Haugesund de Groot Offshore A/S & Co.	34	Hook up and installation work
F.132	Wilh. Wilhelmsen	64	Flotel during hook-up

1.5 NORWEGIAN CONTENT

1.5.1 Norwegian Content by Vendor

The figures shown are based on where the vendors are registered and not where the equipment is produced.

Example Kurt Kohorn is a Norwegian registered company, and delivered Mapegas valves manufactured in France. However, the Norwegian content is set to 100 %.

	<u>OVERALL VALUE KNOK</u>	<u>NORWEGIAN PART KNOK</u>	<u>NORWEGIAN PART %</u>
PURCHASE ORDERS	53.736	38.777	72
CONTRACTS	210.634	158.663	75
PERSONNEL	24.983	20.876	83
TOTAL	291.353	218.316	75

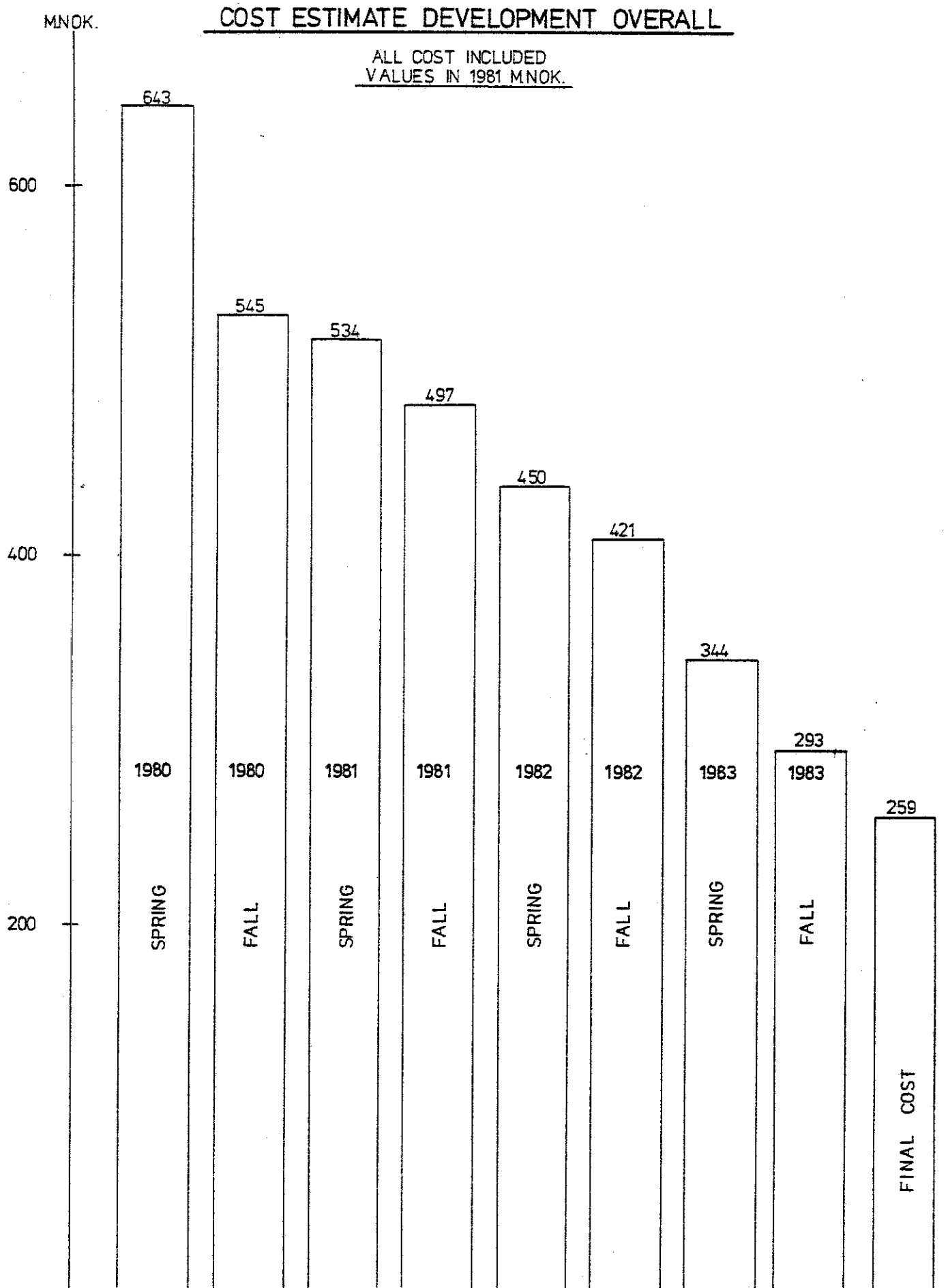
1.5.2 Norwegian Content by Country of Origin

The figures shown are based upon country of origin, that is where the equipment is fabricated.

Example Kurt Kohorn Mapegaz valves. The valves were fabricated in France but delivered by a the Norwegian company. In this case the contribution from the Norwegian agency, Kurt Kohorn, is assumed to be 10%.

	<u>OVERALL VALUE KNOK</u>	<u>NORWEGIAN PART KNOK</u>	<u>NORWEGIAN PART %</u>
PURCHASE ORDERS	53.736	15.926	28,5
CONTRACTS	210.634	137.890	65,5
PERSONNEL (P OR A)	24.983	18.492	74
TOTAL	291.353	173.308	59.5

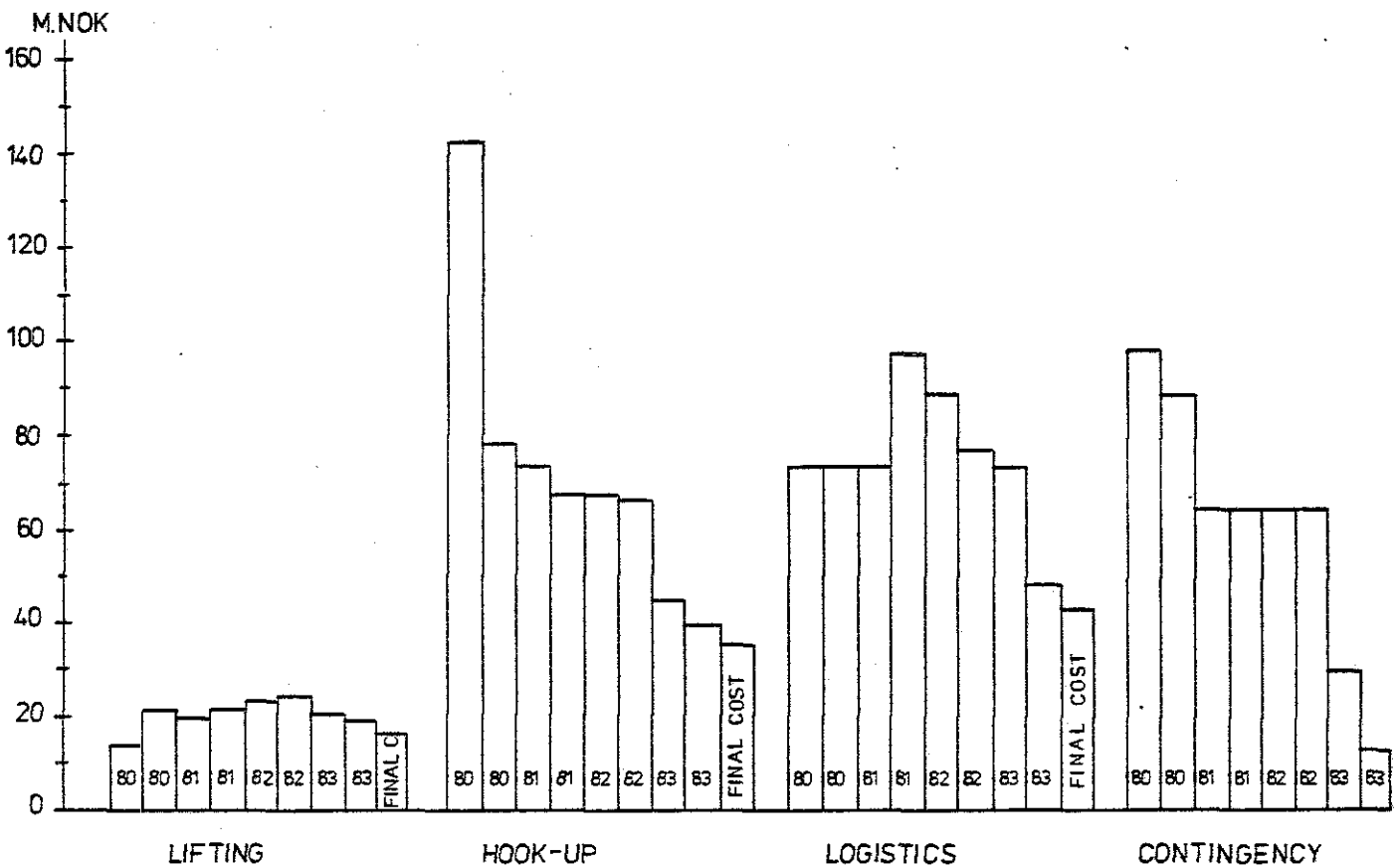
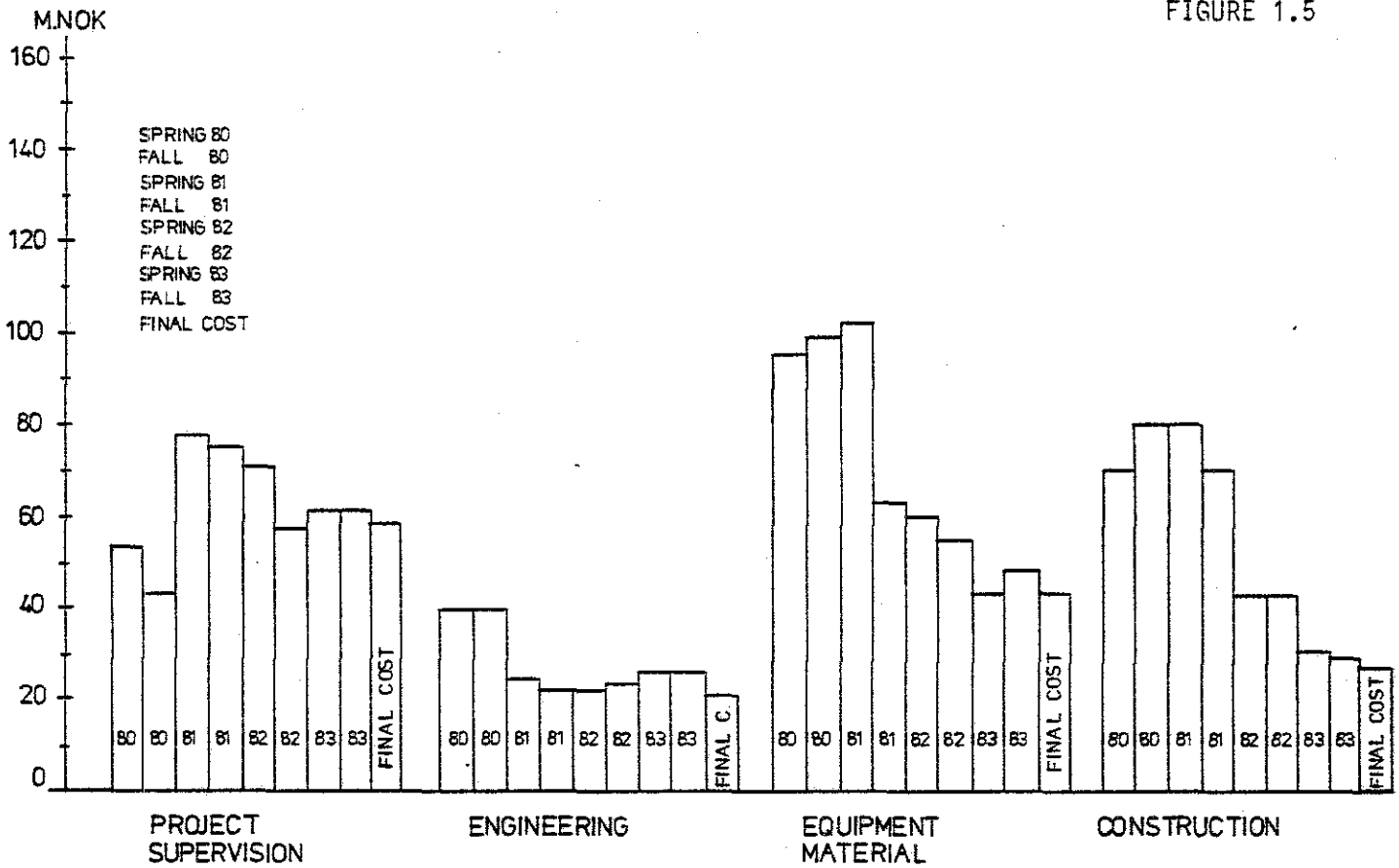
FIGURE 1.4.



COST ESTIMATE DEVELOPMENT BY ACCOUNT

VALUES IN 1981 M.NOK.

FIGURE 1.5



1.6 BUDGETS/COST ESTIMATES

1.6.1 Budget Development

As shown on the histograms (Figure 1.4) the final cost has had an important reduction compared to the original cost estimate. Figure 1.5 shows the cost development by the different cost accounts.

The original cost estimate in 1981 value was 643 mill. NOK, whereas the final cost by January 1984 was 259.284 KNOK. The final cost in current value is 318.872 KNOK.

The main reasons for the cost reduction are:

1. The initial estimate was made in 1980 based upon the experience gained during TCP-2 Compression and Frigg field development. During the years after these projects there have been improvements in all areas of offshore projects.
2. The project was executed during a period with rather low activity in the North Sea. This resulted in hard competition, thus favourable prices were obtained.
3. A realistic project schedule was made which allowed good preparation of the work i.e. the engineering was well advanced when the engineering contract was placed.
4. A rather big project organization was set up to control the project. The project team played an active role in all phases of the project, and did not act only as a supervisory team
5. Only lump sum contracts were used and with extreme low content of changes compared to other offshore projects and the favourable market situation. The result was cost saving.

1.6.2 Budget / Cost Estimate Basis

- Technically, the cost estimate was based on the present status of a prestudy performed by SNEA(P).

- SCHEDULE:

- . Engineering performed in 1981
- . Construction 82 up to first quarter 83
- . Hook Up mid 83

- UNIT COSTS

- . Based on Operator's experience and international market.

- INFLATION RATE

- . In order to be consistent, the inflation rate used throughout the project was 12% (May 1980).

<u>EXCHANGE RATE:</u>	<u>1981</u>	<u>1982</u>	<u>1983-1986</u>
USA US \$	5,47	5,10	4,75
ENGLAND LST £	11,47	10,20	9,30
GERMANY DEM	2,53	2,60	2,70
FRANCE FRF	1,05	1,02	1,00
BELGIUM BEF	0,15	0,15	0,15
HOLLAND NLG	2,25	2,25	2,25

1.7 PROJECT COST

1.7.1 Total Cost in Current Value

The total cost of the project was 318.872 KNOK in current value excl. contingencies. Table 1.6 and Figure 1.7 illustrate the details of the various cost accounts.

It should be noted that a claim for compensation from the Engineering Contractor Sofresid Norge A/S amounting to 10.863 KNOK has not been settled and is not included in the final cost.

1.7.2 Total Cost in 1981 Value

The escalation factor used throughout the project was 12 %.

The actual inflation factor for each year was:

1980	11,09 %
1981	12,60 %
1982	14,03 %
1983	15,21 %

Total cost in 1981 value, is thus 259.284 excl. contingencies shown in fig. 1.7.2, split by year and discipline.

TABLE 1.6

TOTAL COST IN
CURRENT VALUE

BUDGET LINE SUMMARY SHEET WORK RELATED							
ITEM	DESCRIPTION	1980	1981	1982	1983	1984	TOTAL
	PRELIMINARY STUDIES	6.365					6.365
	PROJECT SUPERVISION		10.522	22.635	37.460	1.000	71.617
	ENGINEERING		10.920	8.875	7.257		27.052
	EQUIPMENT AND MATERIAL		695	36.305	15.145		52.145
	CONSTRUCTION			16.624	18.209		34.833
	LIFTING				21.993		21.993
	HOOK UP AND INTEGRATION		41	826	41.384		42.251
	LOGISTICS		444	557	53.088		54.089
	WAREHOUSE			125	905		1.030
	NOC IN NORWAY	194	722	1.591	2.618	19	5.144
	NOC OUT NORWAY	43	257	747	1.294	12	2.353
	TOTAL	6.602	23.601	88.282	199.353	1.031	318.872

TOTAL COST IN CURRENT VALUE
PERCENTAGE SPLIT PER ACTIVITY

FIG 1.7

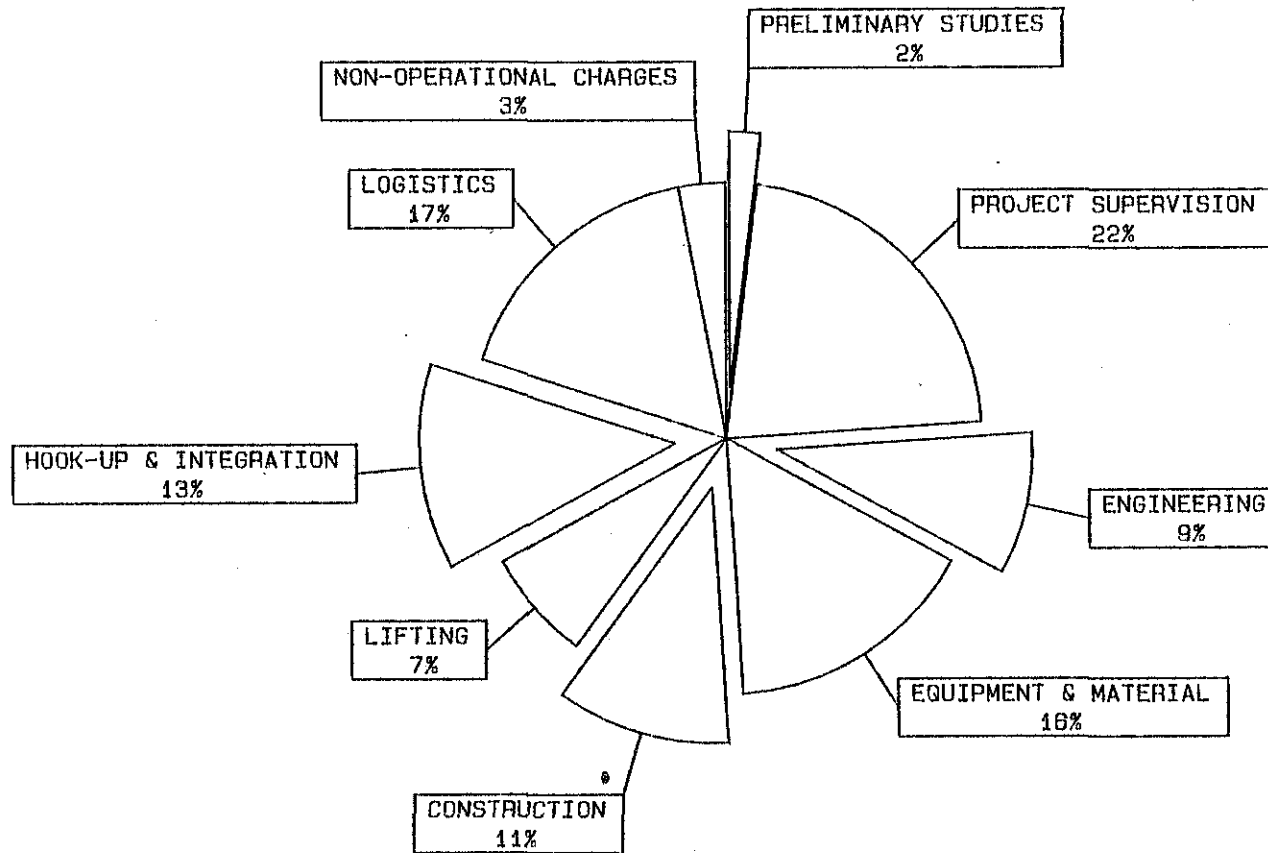


TABLE 1.8

TOTAL COST IN

1981 VALUE

- ACTUAL INFLATION FACTOR

BUDGET LINE	SUMMARY SHEET WORK RELATED	1981 Value					
ITEM	DESCRIPTION	1980	1981	1982	1983	1984	TOTAL
	PRELIMINARY STUDIES	7.071					7.071
	PROJECT SUPERVISION		10.522	19.840	28.222	754	59.338
	ENGINEERING		10.920	7.779	5.467		24.116
	EQUIPMENT AND MATERIAL		695	31.821	11.410		43.926
	CONSTRUCTION			14.571	13.719		28.290
	LIFTING				16.569		16.569
	HOOK UP AND INTEGRATION		41	724	31.178		31.943
	LOGISTICS		444	448	39.996		40.928
	WAREHOUSE			110	682		792
	NOC IN NORWAY	215	722	1.394	1.972	14	4.317
	NOC OUT NORWAY	48	257	655	975	9	1.944
	TOTAL	7.334	23.601	77.382	150.190	777	259.284

1.7.3 Commitment Against Time

Total commitment against time is shown on figure 1.9.

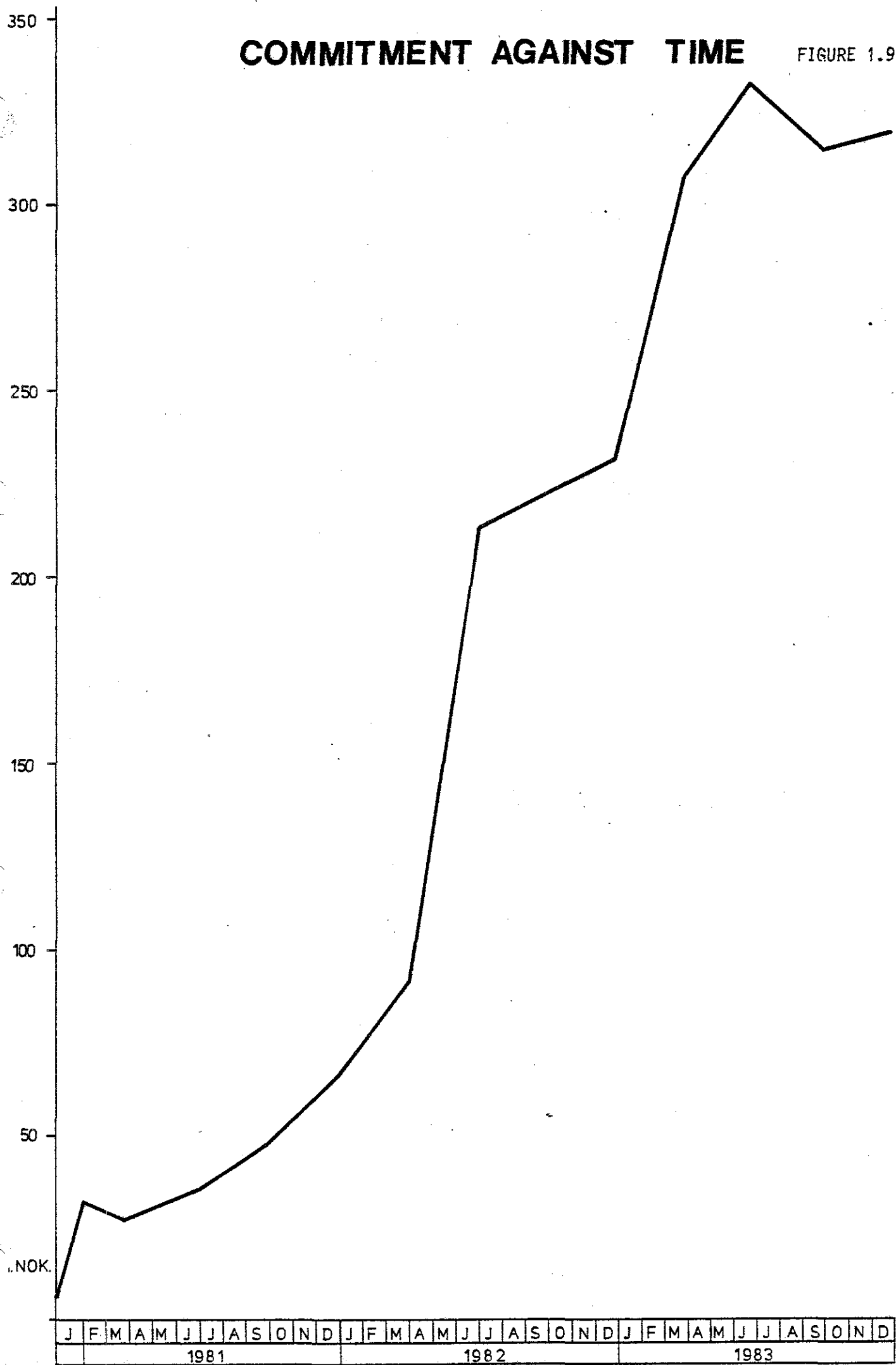
Note that the reduction in March 1981 is due to a decrease in the cost estimate for the engineering contract.

The reduction in Sept. 1983 is due to reduction in the cost estimates for hook-up and logistics, as part of these costs were allocated to other departments within EAN.

The figures are in current value.

COMMITMENT AGAINST TIME

FIGURE 1.9



1.7.4 Expenditure Against Time

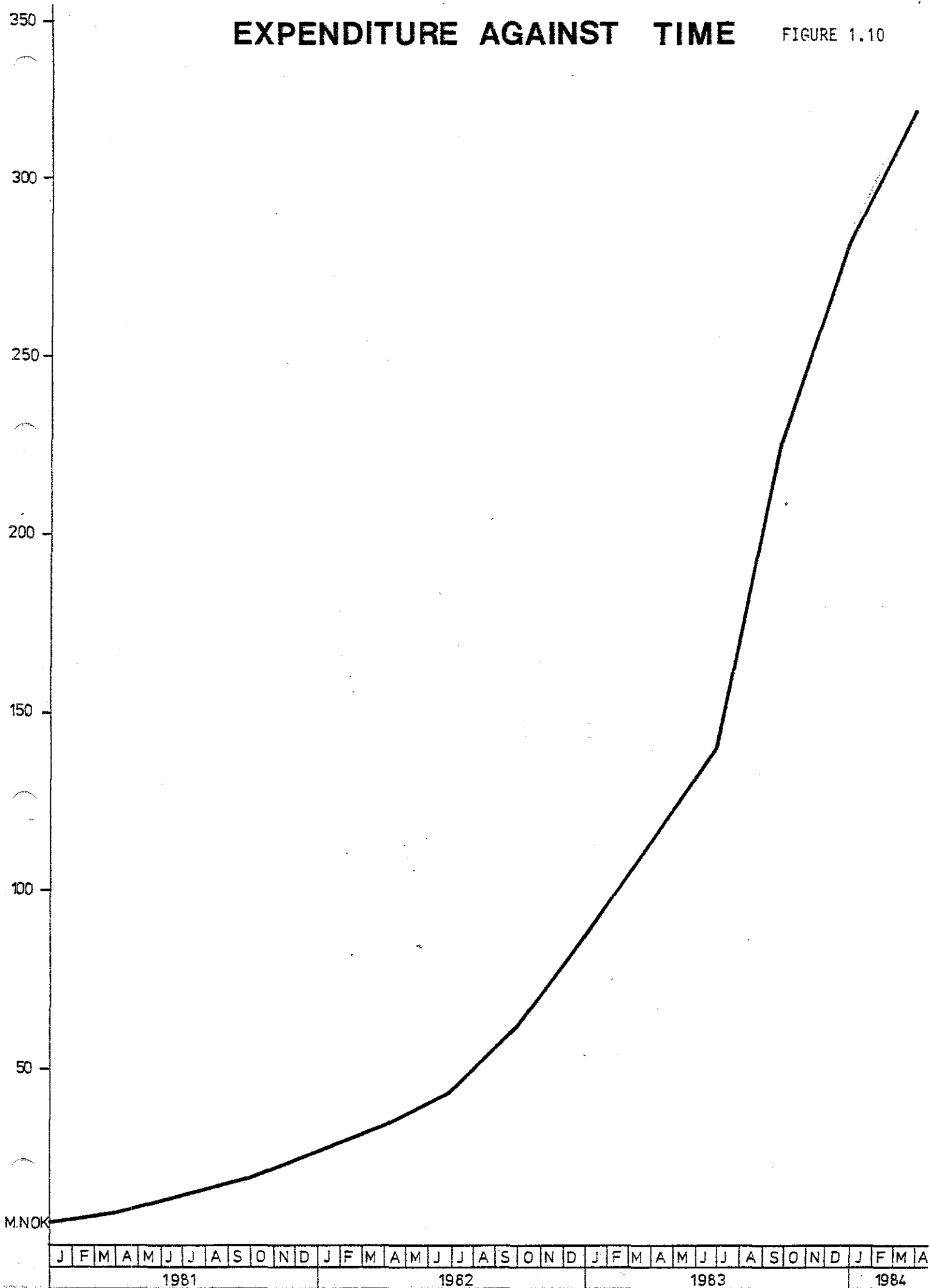
Total expenditures against time is shown on figure 1.10.

As can be seen from this figure, the main part of the expenses were paid in the last half of 1983, i.e. hook-up and logistic costs.

The figures are in current value.

EXPENDITURE AGAINST TIME

FIGURE 1.10



1.7.5 Split by Currency

Split of the total cost in currencies:

CURRENCY	COMMITTED COST		PAID IN KNOK
	VALUE IN ORIGINAL CURRENCY	VALUE IN KNOK	
FRF	76.027.000	77.089	75.450
GBP	849.000	8.969	9.502
NLG	7.768.000	17.478	19.956
BEF	119.000	18	18
US \$	546.000	2.756	4.476
DM	105.000	272	322
NOK	-	209.148	209.148
TOTAL	-	315.730	318.872

1.7.6 Gain / Loss in Currencies

The following exchange rates were used as fixed rates throughout the project for the committed cost:

<u>Exchange Rate:</u>	<u>1981</u>	<u>1982</u>	<u>1983-1986</u>
USA US \$	5.47	5.10	4.75
ENGLAND LST £	11.47	10.20	9.30
GERMANY DEM	2.53	2.60	2.70
FRANCE FRF	1.05	1.02	1.00
BELGIUM BEF	0.15	0.15	0.15
HOLLAND NLG	2.25	2.25	2.25

Exchange Gain / Loss in NOK:

<u>Currency</u>	<u>Gain</u>	<u>Exchange</u>	<u>Loss</u>
FRF	1.639.000		
GBP			533.000
NLG			2.478.000
BEF	-		-
US \$			1.720.000
DM			50.000
TOTAL LOSS:			3.142.000

The loss is due to the fact that the fixed exchange set in 1981 was too low for GBP, NLG and US \$.

1.7.7 Gain / Loss Escalation

Figure 1.8 is showing total project cost in 1981 value with the actual escalation factor, whereas figure 1.11 is showing total project cost with the escalation factor used throughout the project; 12%.

Total cost with actual escalation = 259.284 KNOK

Total cost with 12% escalation = 269.480 KNOK

Total "loss" with actual inflation rate compared to the forecasted inflation rate was thus; 10.196 KNOK.

FIGURE 1.11.

TOTAL COST IN

1981 VALUE - (12 % Escalation)

BUDGET LINE	SUMMARY SHEET WORK RELATED	1981 Value					
ITEM	DESCRIPTION	1980	1981	1982	1983	1984	TOTAL
	PRELIMINARY STUDIES	7.129					7.129
	PROJECT SUPERVISION		10.522	20.210	29.863	712	61.307
	ENGINEERING		10.920	7.924	5.785		24.629
	EQUIPMENT AND MATERIAL		695	32.415	12.074		45.184
	CONSTRUCTION			14.843	14.516		29.359
	LIFTING				17.533		17.533
	HOOK UP AND INTEGRATION		41	738	32.991		33.770
	LOGISTICS		444	497	42.321		43.262
	WAREHOUSE			112	722		834
	NOC IN NORWAY	217	722	1.420	2.087	14	4.460
	NOC OUT NORWAY	48	257	667	1.032	9	2.013
	TOTAL	7.394	23.601	78.826	158.924	735	269.480

2 PROJECT MANAGEMENT

2.1 ORGANIZATION

The EAN project team was organized as a traditional project organization. There were four different sections: Engineering, Construction, Procurement and Project administration. The Quality Control and Quality Assurance group and the Secretariat worked as staff functions.

Several categories of personnel were involved such as EAN local employees, Elf Group employees, Partners and Contracted personnel.

The following nationalities were represented:

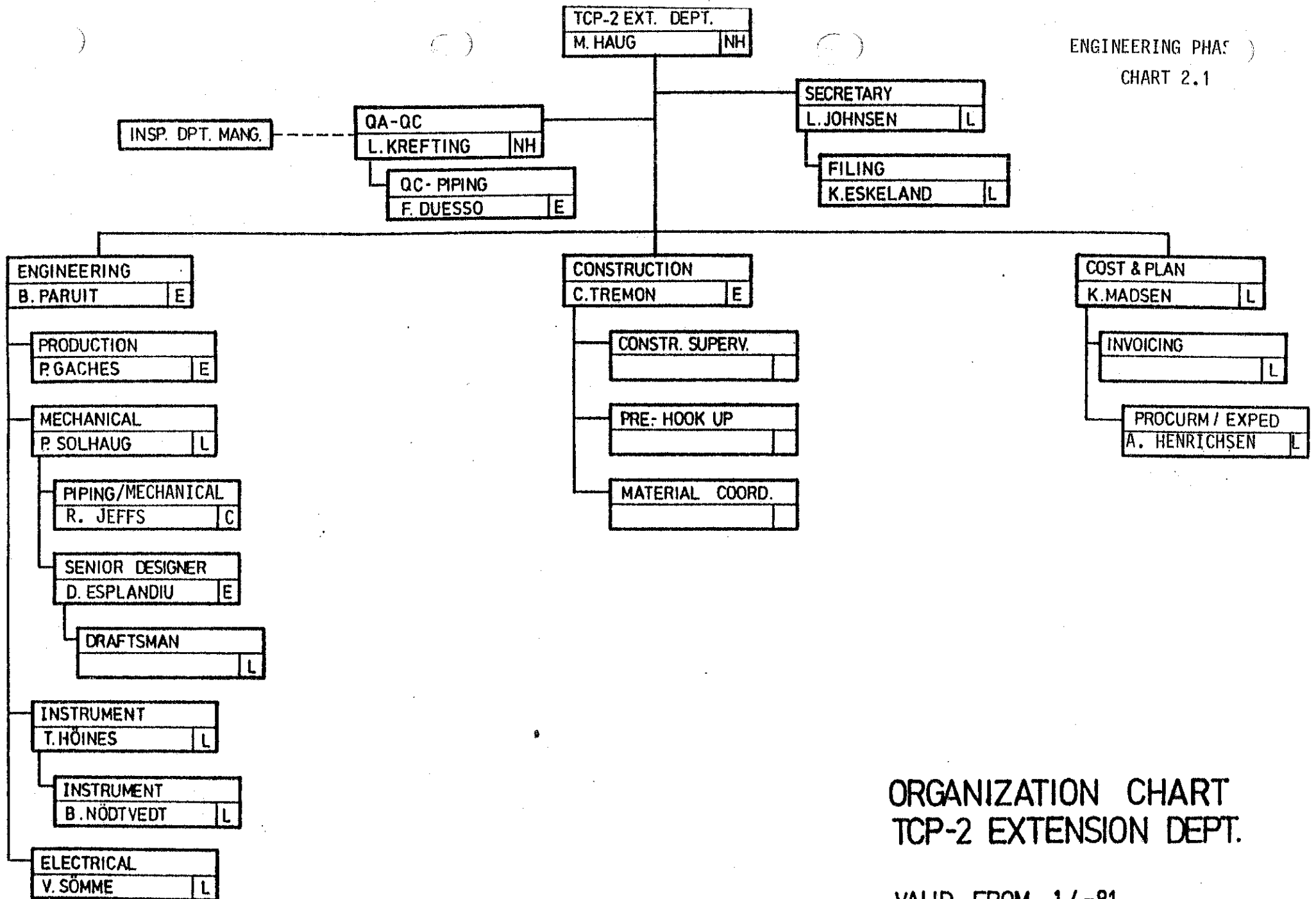
- French
- British
- American
- Swedish
- Finnish
- Norwegian

The majority of the team were Norwegians.

Except for one draftsman, there was no turn over during the project life time.

The organization chart for the following phases of the project are shown:

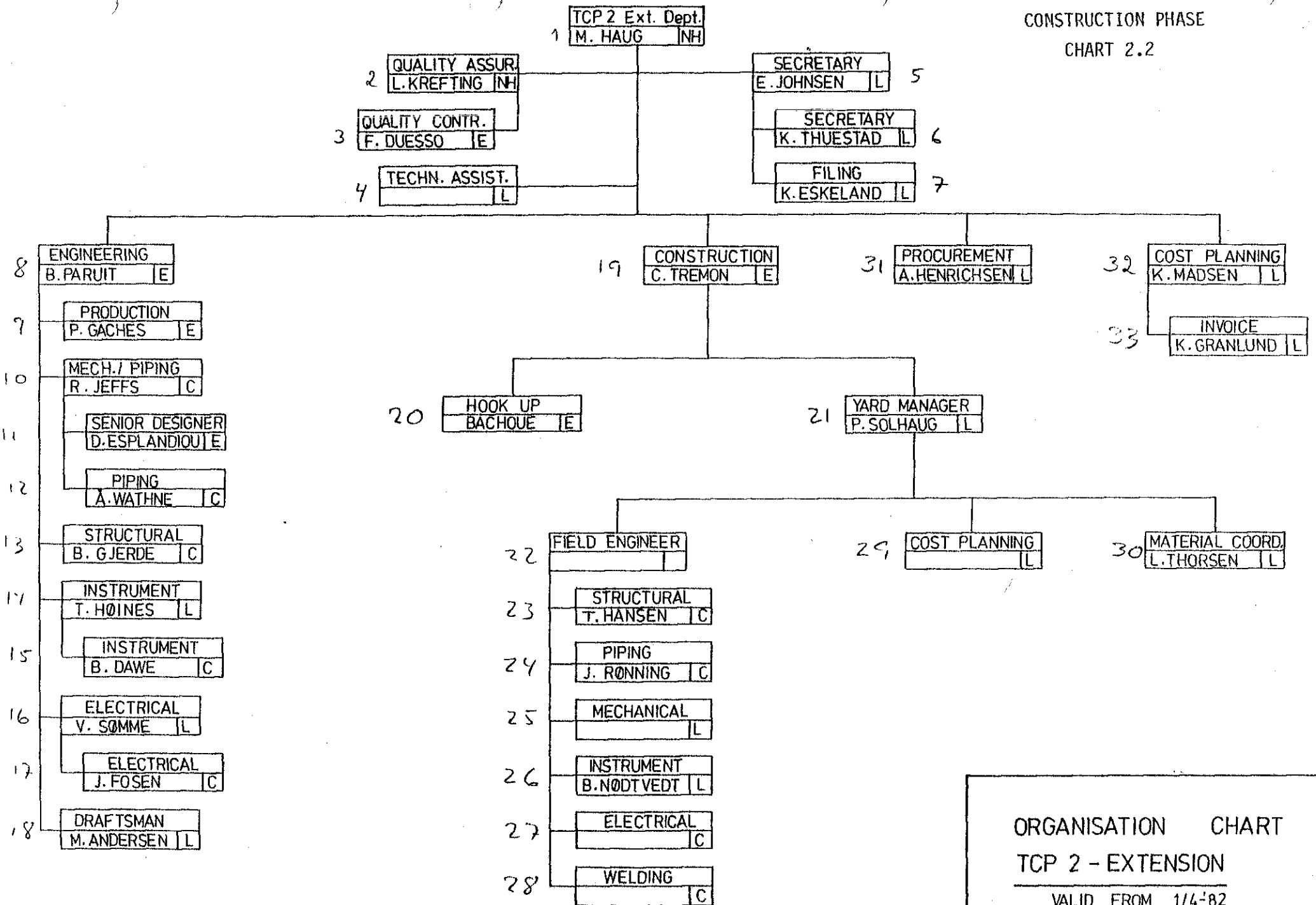
- Engineering Chart 2.1
- Construction Chart 2.2
- Hook Up & Commissioning Chart 2.3



ORGANIZATION CHART
 TCP-2 EXTENSION DEPT.

VALID FROM 1.4-81

CONSTRUCTION PHASE
CHART 2.2



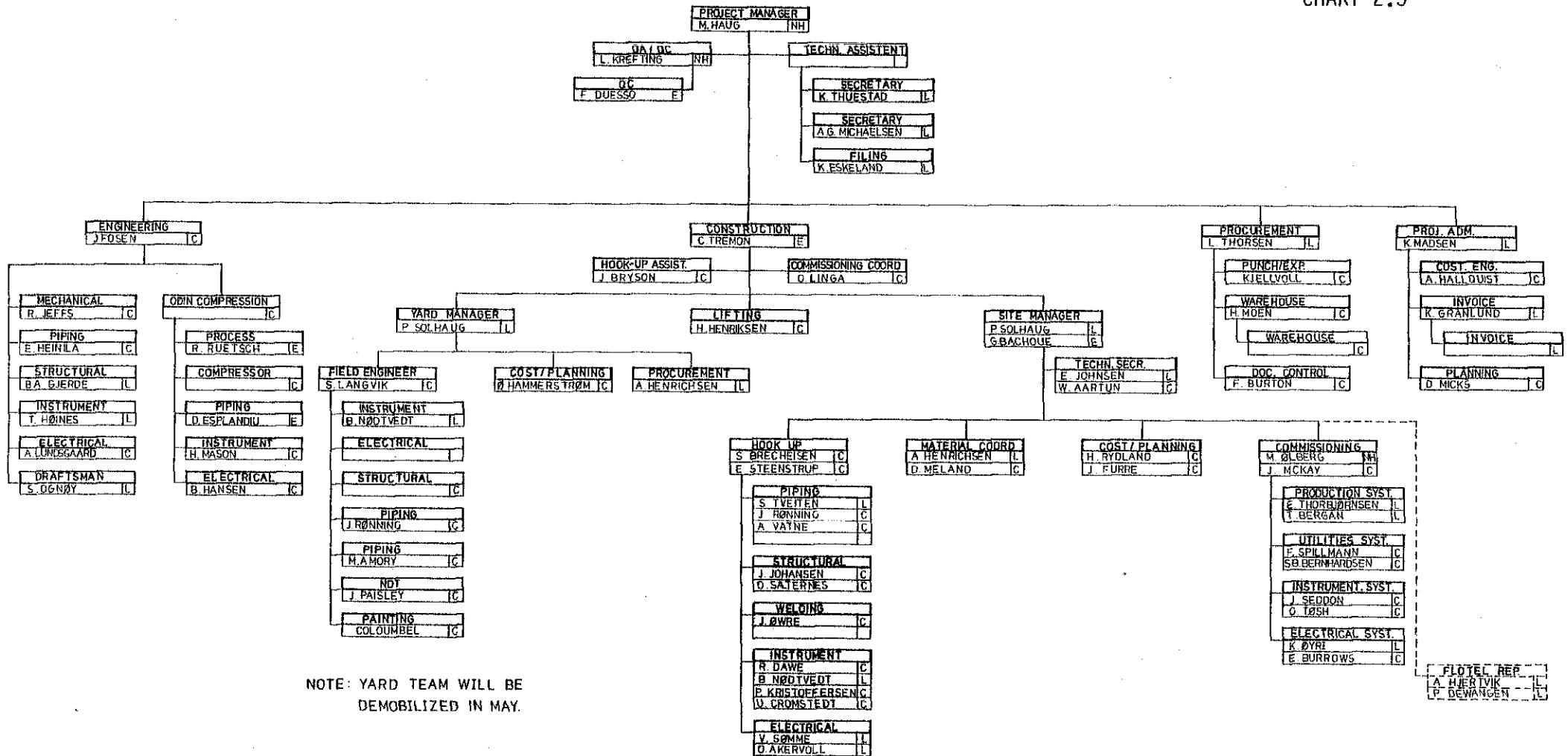
ORGANISATION CHART
TCP 2 - EXTENSION

VALID FROM 1/4-82

TCP 2 EXTENSION DEPARTMENT

HOOK UP AND COMMISSIONING PHASES

CHART 2.3



NOTE: YARD TEAM WILL BE DEMOBILIZED IN MAY.

2.2 PROJECT SUPERVISION COST

The total final cost in current value for the budget line project supervision was:

1981	:	10.522	KNOK
1982	:	22.635	"
1983	:	37.460	"
1984	:	1.000	"

TOTAL	:	71.617	KNOK
-------	---	--------	------

The major personnel costs is shown in Chapters 2.3 and 2.4.

2.2.1 LOCAL PERSONNEL

Cost local personnel 1981 : 2.894 KNOK
 " " " 1982 : 4.795 "
 " " " 1983 : 8.005 "

TOTAL COST FOR LOCAL PERSONNEL : 15.694 KNOK

Manmonths local personnel were split according to the following schedule:

YEAR	CATEGORY	ONSHORE		OFFSHORE	
		NUMBER	MONTHS	NUMBER	MONTHS
1981	Senior	3	32 1/2		
	Confirmed	4	27 1/2		
	Junior	4	34 1/2		
1982	Senior	3	31		
	Confirmed	4	43		
	Junior	6	63		
1983	Senior	5	43	2	10
	Confirmed	11	74	7	29
	Junior	6	63	1	5

2.2.2 EXPATRIATE PERSONNEL

Cost expatriate personnel	1981	:	5.057	KNOK
" " "	1982	:	6.302	"
" " "	1983	:	4.729	"

TOTAL COST FOR EXPATRIATE PERSONNEL : 16.088 KNOK

Manmonths expatriate personnel were split according to the following schedule:

YEAR	CATEGORY	NUMBER	ONSHORE		OFFSHORE	
			NUMBER	MONTHS	NUMBER	MONTHS
1981	Senior	1		8 1/2		
	Confirmed	3		34		
	Junior	1		11		
1982	Senior	1		11		
	Confirmed	2		23		
	Junior	2		21		
1983	Senior	1		12		
	Confirmed	1		8	1	5
	Junior	2		17		

2.2.3 CONTRACTED PERSONNEL

Cost contracted personnel	1981	:	1.737	KNOK
" " "	1982	:	8.706	"
" " "	1983	:	20.688	"

TOTAL COST FOR CONTRACTED PERSONNEL : 31.131 KNOK

Manmonths contracted personnel were split according to the following schedule:

YEAR	CATEGORY	NUMBER	ONSHORE		OFFSHORE	
			NUMBER	MONTHS	NUMBER	MONTHS
1981	Senior					
	Confirmed	2		8		
	Junior	2		17 1/2		
1982	Senior					
	Confirmed	10		78		
	Junior	4		43		
1983	Senior	1		3	1	3
	Confirmed	34		115	18	81
	Junior	14		67	5	22

2.2.4 OTHER CONTRACTS / ASSISTANCE

Other main contracts for Project Management were the following:

SNEA(P)

The following Devi de Commandes were issued for assistance from SNEA(P):

103.500.000 Continuing of preliminary studies.

Total cost:	1981 :	149.400 NOK
	1982 :	183.300 NOK
	1983 :	312.900 NOK
	TOTAL:	<u>645.600 NOK</u>

103.500.062 Non-destructive tests for inspection of pre-fabrication of piping.

Total cost:	<u>55.900 NOK</u>
-------------	-------------------

103.500.073 Spot assistance from DDT/REA

Total cost:	<u>26.000 NOK</u>
-------------	-------------------

Total cost for SNEA(P) assistance: 726.900 NOK

Det norske Veritas (DnV)

The following contract and contract amendments were issued for assistance from DnV:

S.818	Review of drawings and documents.	
	Total cost:	811.300 NOK
S.818/01	Certificate of fitness for NEF/ODIN risers.	
	Total cost:	426.900 NOK
S.818/02	Safety evaluation	
	Total cost:	140.000 NOK
S.818/05	Yard assistance	
	Total cost:	1.128.500 NOK
S.818/07	Yard QA/QC Manual part I and II	
	Total cost:	196.300 NOK
S.818/10	QA services offshore	
	Total cost:	107.900 NOK
S.818/11	Non-destructive metallographic examination	
	Total cost:	28.200 NOK
S.818/12	Development of ultraprocedure for T-measurement	
	Total cost:	39.800 NOK
S.818/13	Onshore/Offshore inspections	
	Total cost:	587.300 NOK

Total cost for DnV inspections: 2.337.700 NOK

Total cost yard assistance : 1.128.500 NOK

Others

In addition to DnV and SNEA(P) the following contracts were issued for Project Management:

Contract No. X.072 - Genair Lease Air Ltd. - Charter flights Newcastle-Stavanger-Newcastle used by TCP-2 Extension personnel during the hook-up period.

Total cost: 33.000 NOK

Contract No. F.181 - Qualitest - Anticorrosion control at the yard.

Total cost: 237.000 NOK

Contract No. F.185 - Metall Kontroll A/S - Painting inspections at vendors' workshops.

Total cost: 116.200 NOK

P.O. 83.00.060 and 82.25.216 Helly Hansen A/S - Rental of survival suits.

Total cost: 264.400 NOK

Contract No. F093 R. Bjerck A/S - Structural Design Engineering.

Total cost: 200.000 NOK

TCP-2 Extension Training.

Total cost: 235.000 NOK

Misc. Purchase Orders issued 1981, 1982 and 1983.

Total cost: 3.425.000 NOK

3. ENGINEERING

3.1 SUMMARY

In January 1981 Sofresid Norge A/S (SN) was awarded a lump sum contract covering the Engineering and Procurement Services.

The value of the contract was 16.5 MNOK, however, including escalation and change orders and additional work final contract value was 24 MNOK.

Additional engineering work was also sub-contracted to other engineering contractors when this was considered advantageous to the project.

The total cost of the Budget Line "Engineering" was 27.052 KNOK.

A claim from Sofresid Norge A/S amounting to 10.863 KNOK has not been settled and is not included in the final cost.

3.2 TENDER/BID EVALUATION

The Bid Evaluation of the Engineering Contract is shown in Appendix 1.

3.3 ORGANIZATION OF THE WORK

The office location of Sofresid Norge A/S (SN) for the execution of the Engineering Services was in Stavanger.

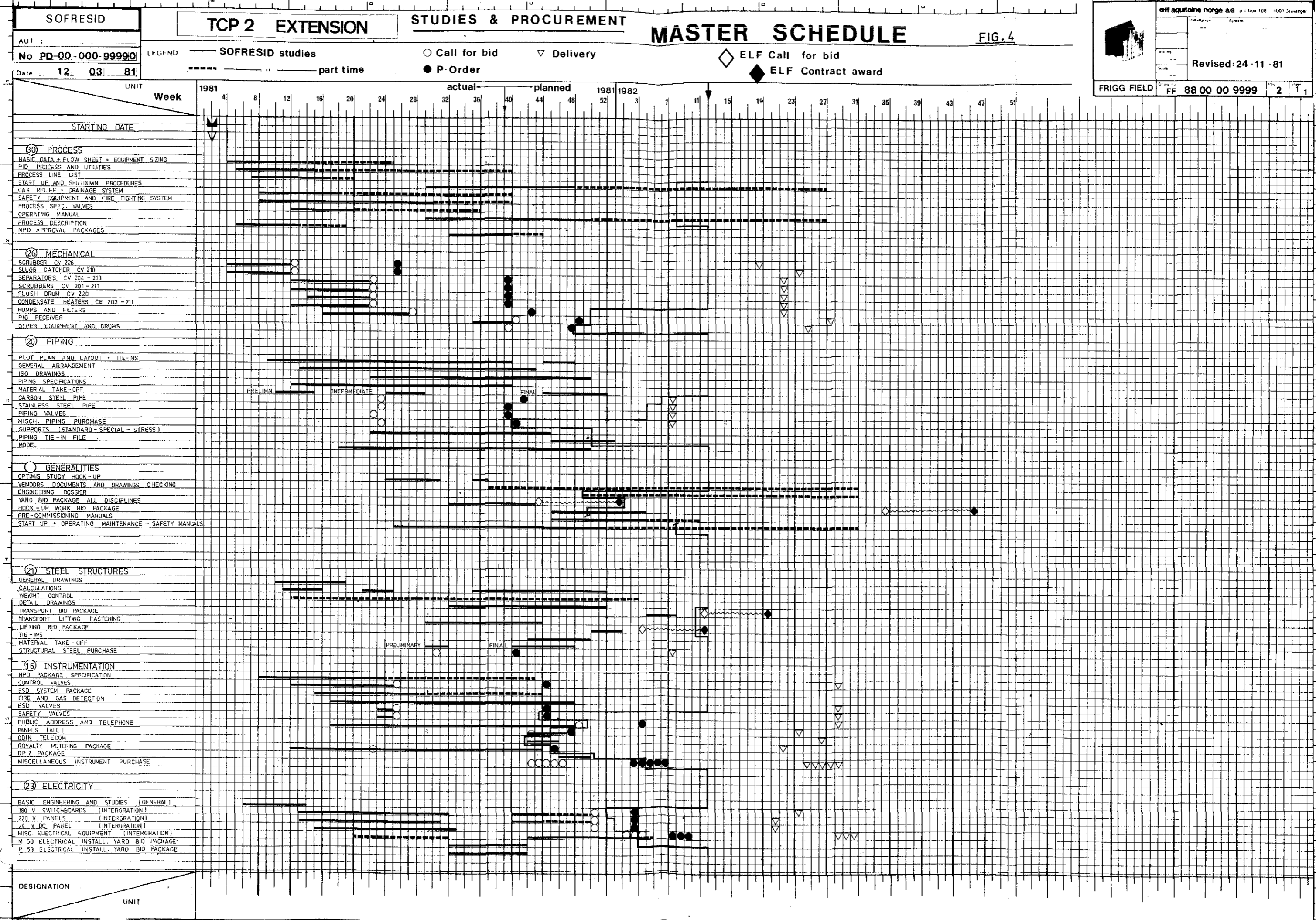
SN had their offices 300 m from the EAN project office thus frequent contacts were made.

However, the two organizations worked independently and all communication between the parties were done by numbered letters (LEC/LCE).

3.4 PLANNING/PROGRESS

The Master Schedule for the Engineering and Procurement Services is shown in figure 3.1, followed by the Overall Progress Curve (figure 3.2) and the Detailed Progress Curve by Discipline (figure 3.3).

FIGURE 3.1

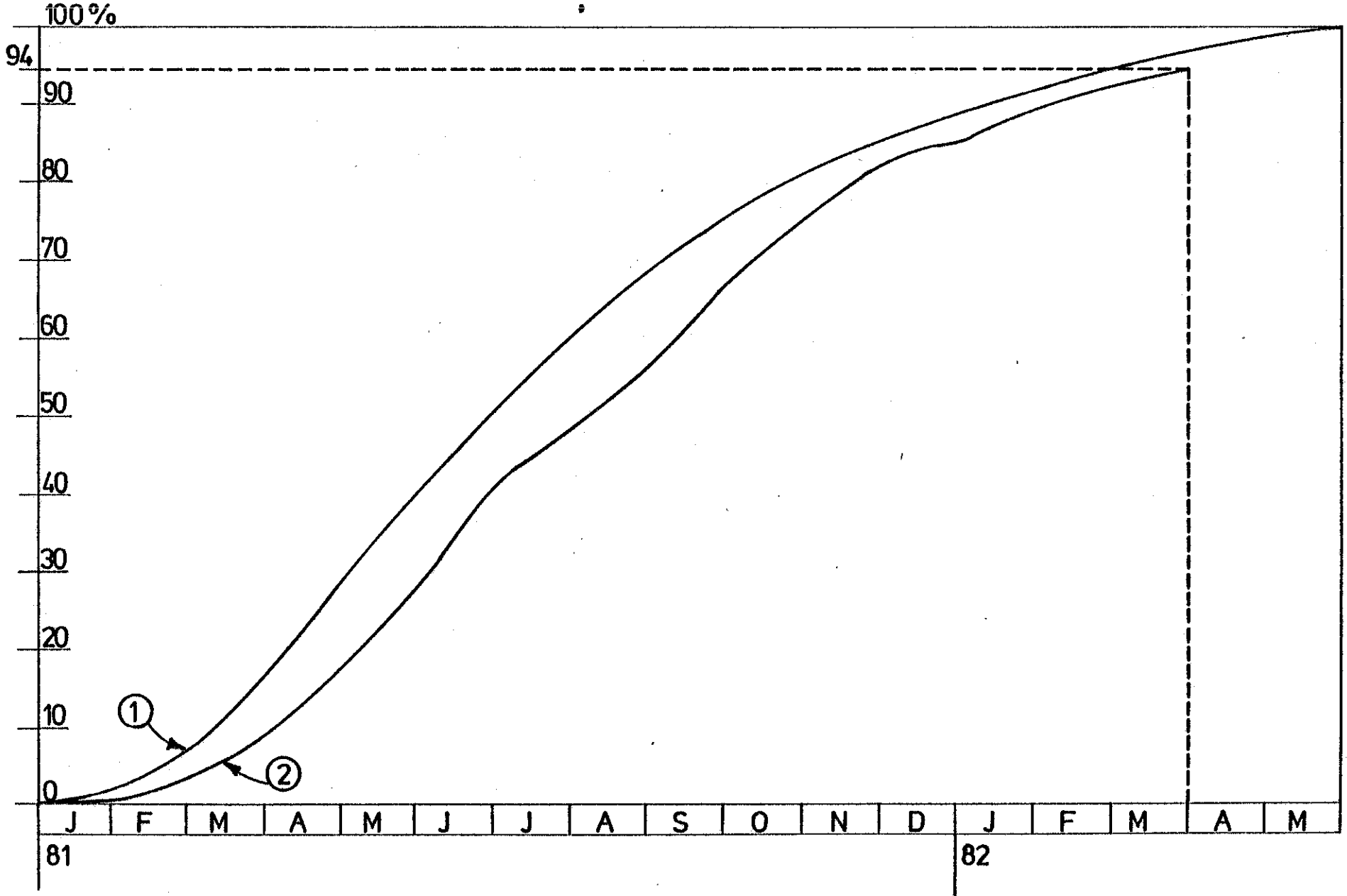


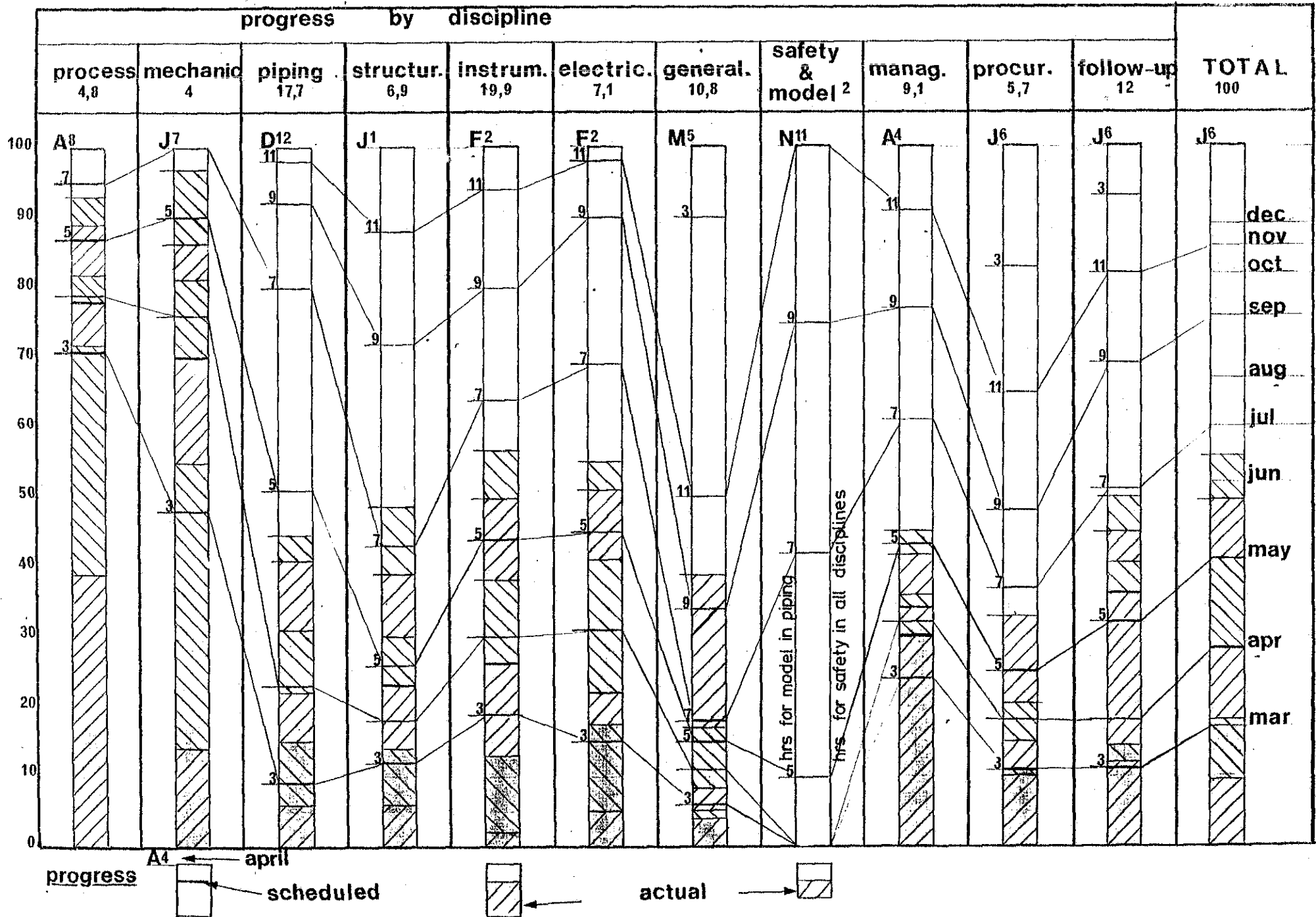
off aquitaine norge a/s p.o. box 168 4001 Stavanger
 Installation System
 Revised: 24-11-81
 FRIGG FIELD Draw. No. FF 88 00 00 9999 2 1

TCP-2 EXTENSION — PROGRESS CURVES (Studies.)

FIGURE 3.2

- ①-theoretical
- ②-actual





3.5 COST

The final cost of the Engineering Budget Line in current value was 27.052 KNOK.

The major part of this, 25 MNOK, is related to the main Engineering Contractor - Sofresid Norge A/S. The split between lump sum, additional work, changes and site assistance is shown hereafter.

3.5.1 Lump Sum

The contract value of the lump sum was 16.542 KNOK.

Including escalation the total lump sum paid amounts to 17,6 MNOK.

The lump sum was paid according to the following schedule:

Scheduled dates	Percentage to be invoiced	Cumulative Percentage
1. Upon signature of the Contract	5	5
2. Upon Company's approval of the Programme (Article 4)	5	10
3. Upon Company's approval of basic engineering documents (Annex B §1.1)	10	20
4. Upon Company's approval of Purchase Orders for 60% of the value of the tagged equipment (Annex A §6.1.1)	5	25
5. Upon Company's approval of Purchase Orders for 95% of the value of the tagged equipment (Annex A §6.1.1)	10	35
6. Upon Company's approval of the technical part of the bid package for construction (Annex A §2.3.2)	20	55
7. Upon Company's approval of the technical part of the bid package for the lifting (Annex A §2.3.2)	5	60
8. Upon Company's approval of the technical part of the bid package for the hook up works (Annex A §2.3.2)	10	70
9. Upon Company's approval of all the manuals (Annex B §1.2)	5	75
10. Upon delivery and acceptance on Yard of all tagged equipment (Annex A §6.1.1)	12	87
11. Upon delivery and acceptance of all bulk material	12	99
12. Upon Acceptance of the Services (Annex A §5.2.4)	1	100

3.5.2 Additional Work - Changes

Additional work and change orders amounted to 6.4 MNOK, i.e. 36.4% of the lump sum.

3.5.3 Site Assistance

Total amount paid for site assistance was 1,5 MNOK. 0,5 MNOK of this was yard assistance, and 1 MNOK was hook-up assistance.

3.5.4 Other Contracts

Other contracts included in this budget line was:

Aker Engineering A/S, Contract No. F.089

Total cost: 600.000 NOK

Kvaerner Engineering A/S, Contract No. F.021

Total cost: 350.000 NOK

DMS Consultants A/S, Contract No. F.047

Total cost: 350.000 NOK

Petcon Engineering A/S, Contract No. F.097

Total cost: 170.000 NOK

Miscellaneous minor contracts.

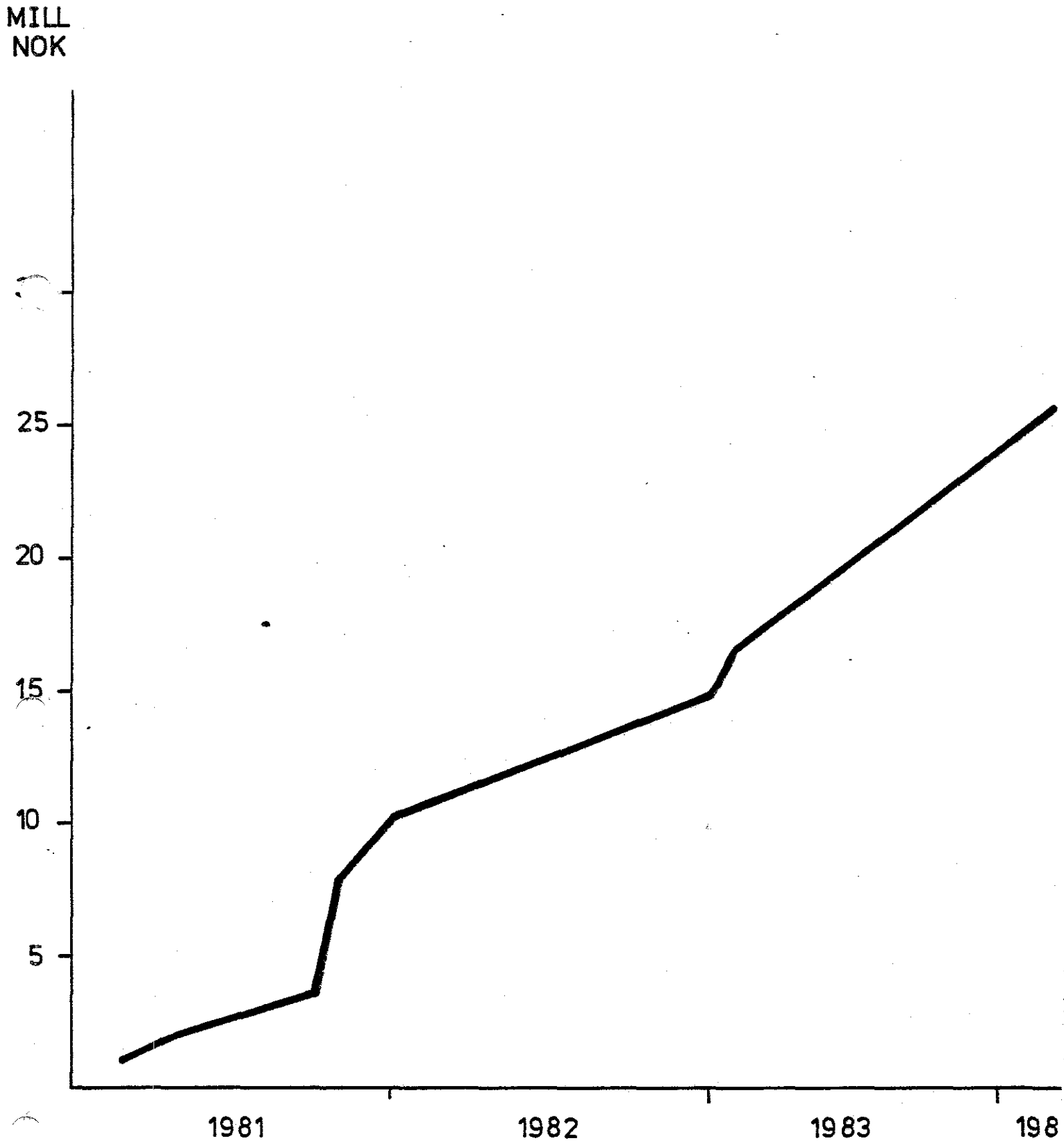
Total cost: 82.000 NOK

3.5.5 Expenditure Against Time

Total expenditure against time is shown on figure 3.4.

EXPENDITURE AGAINST TIME CONTRACT F.087 ENGINEERING

FIGURE 3.4



3.6 EXPENDED MANHOURS

The total expended engineering manhours of the main Engineering Contractor (Sofresid Norge A/S) was :

EXPENDED MANHOURS

ENGINEERING	1981	1982	TOTAL	79.300
SAFETY	7.020	4.980	12.000	
INSTRUMENTATION	15.211	10.789	26.000	
ELECTRICAL	3.157	2.143	5.300	
PIPING	15.116	6.884	22.000	
MECHANICAL	857	643	1.500	
STRUCTURAL	5.478	1.521	7.000	
PROCESS	3.559	1.941	5.500	
PROCUREMENT				8.000
MANAGEMENT				6.000
TOTAL				<u>93.000</u>

On figure 3.5 a manpower histogram is shown.

Split by year: (Engineering only).

According to the ratio of overall manmonths (Ref. manpower histogram) expended manhours per year will be:

1981:

$$\frac{312}{486} \times 79.300 = \underline{50.907}$$

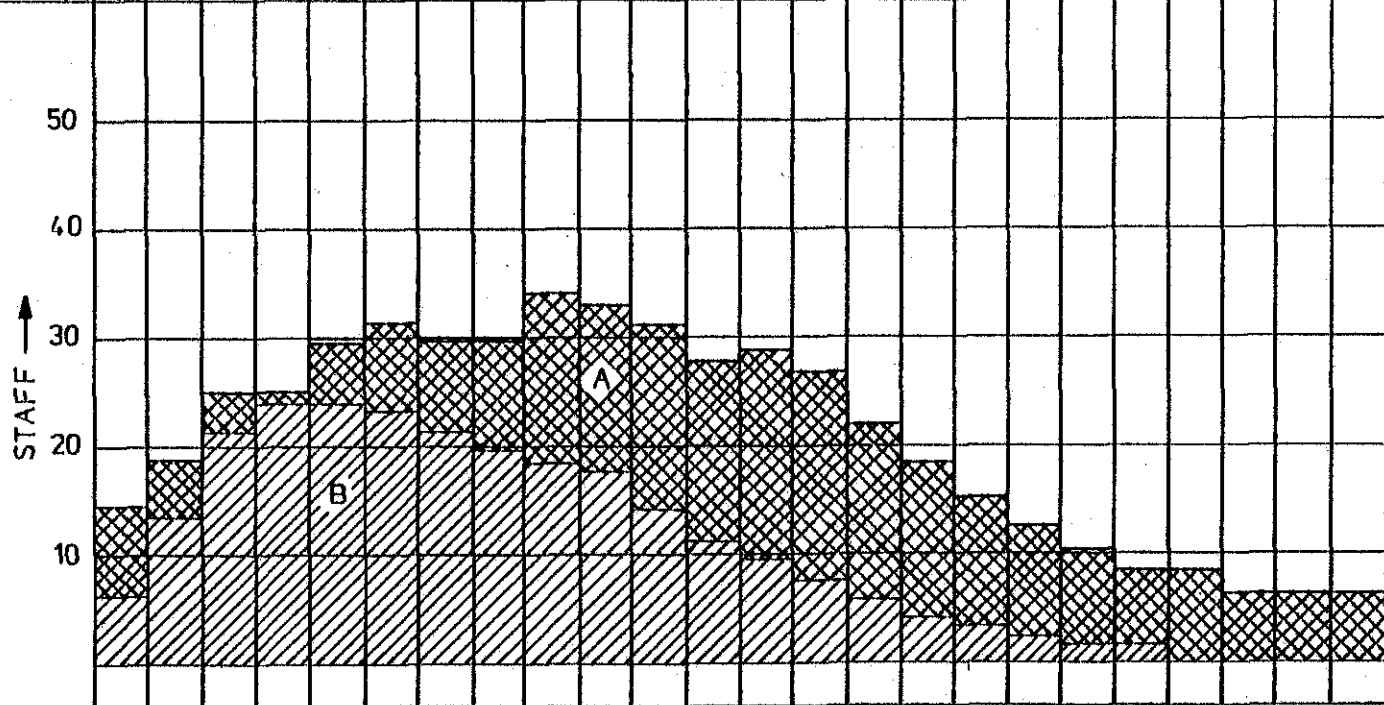
$$\frac{174}{486} \times 79.300 = \underline{28.393}$$

MANPOWER HISTOGRAM (BUDGET AND ACTUAL)

FIGURE 3.5

1981 ← → 1982

CALENDAR		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	BUDG HOURS	ACT. HOURS
ENGINEERING STAFF																											
MANAGEMENT	B	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1									
	A	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1		
PROCESS	B	2	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1									
	A	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1			
PIPING	B	3	3	6	6	6	6	6	6	6	5	3	2	2	1	1	1	1									
	A	2	3	6	8	9	9	10	10	11	12	11	10	9	9	7	6	5	3	2	1	1	1	1			
STRUCTURAL	B	1	3	3	3	3	2	2	2	1	1	1	1	1													
	A	0	1	3	3	3	3	3	4	4	4	4	4	3	2	1											
ELECTRICAL	B	2	3	3	2	2	2	2	2	2	1	1	1/2	1/2	1/3	1/3	1/3										
	A	0	1	2	2	3	3	3	3	3	3	3	2	3	3	2	2	2	1	1	1	1	1	1			
INSTRUMENT	B	2	3	6	7	7	7	5	4	4	4	7	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2						
	A	2	3	4	6	9	10	8	8	11	9	8	8	9	8	8	7	6	6	5	3	3	2	2	2		
MECHANICAL	B	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
	A	0	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
SAFETY	B	1	1	1	1	1	1	1	1	1	1	1	1	1													
	A	0	0	0	0	0	0	0	0	0	0	0	0	0													
TOTALS	B	14	19	25	24	24	23	21	20	19	18	15	11	10	8	6	5	4	3	2	2	0	0	0	0	486	
	A	6	13	21	25	30	31	30	30	34	33	31	28	29	27	22	19	16	13	11	8	8	7	7	7		



B = BUDGET
A = ACTUAL

3.7 RATIOS

The ratios given are based upon expended manhours in Chapter 3.6.

Drawings related to the yard construction is based upon expended manhours in 1981.

	NUMBER OF DRAWINGS	DISCIPLINE HRS/ DRAWINGS
GENERAL DRAWINGS	21	
GENERAL SAFETY DRAWINGS	10	
GENERAL PLOT PLANS & ARRANGEMENT	9	
MECHANICAL	12	
PIPING PLOT PLANS LAYOUT/GEN ARR.	17)	
PIPING SUPPORTS	112)	44.9
ISOMETRIC	208)	
STRUCTURAL	27)	171
LOAD OUT & SEAFASTENING	5)	
INSTRUMENTATION	72	211
ELECTRICAL	40	79
TOTAL	533	

OVERALL:

NUMBER OF PID'S	:	8
OVERALL ENG.MHRS	:	79.300
HRS PER PID	:	9.912,5

4 PROCUREMENT

4.1 ORGANIZATION OF WORK

4.1.1 EAN Organization

The procurement phase and responsibility was split in two during the project. The first part of the activity was from call for tender issue until vendor selections. During this phase the responsibility was split between engineering section which was responsible for technical part and procurement section which was responsible for commercial part.

After vendor selection cost & planning section got involved in the work of getting the required approvals both internally in EAN and externally at the Ministry of Petroleum and Energy.

From the time the purchase order was issued the responsibility to coordinate remaining work until delivery was undertaken by procurement section.

The Procurement section acted both as a Supervisory team and an active Procurement team including Purchasing, Inspection, Expediting and Transportation activities.

All additional Procurement during the Yard Construction and the Hook-Up was done by the EAN Project Team.

4.1.2 Sofresid Norge A/S (SN) Organization

SN was responsible, as part of the Contract F.087, for procurement of all material needed for TCP-2 Extension.

Their work covered all matters from issue of call for tender until transportation. The different steps in this process were approved by EAN in advance, but SN did the preparation work and acted on our behalf towards suppliers.

Due to problems and limited resources with the Engineering Contractor, part of the works were carried out by EAN directly.

4.2 COST OF MATERIAL & EQUIPMENT

The total cost of Material and Equipment in current value is 52.145 KNOK.

Value of equipment purchased by Sofresid Norge A/S	46 104 619
" " " " " EAN	6 040.381

Number of orders issued by Sofresid Norge A/S	90
" " " " " EAN	468

4.2.1 Cost Piping

CURRENCY	NOK	TOTAL NOK
FRF 6 970 239	7 121 554	
GBP 17 976	182 117	
DEM 26 909	68 079	
BEC 142 570	21 385	
NLD 26 035	58 582	
NOK	7 436 596	14 888 313

4.2.2 Cost Mechanical

CURRENCY	NOK	TOTAL NOK
GBP 331 616	3 706 653	
NLD 463 581	1 062 308	
NOK	1 131 443	5 900 404

4.2.3 Cost Structural

CURRENCY	NOK	TOTAL NOK
FRF 332 445	339 094	
DEM 229 998	559 597	
NOK	2 065 419	3 004 110

4.2.4 Cost Instrument

CURRENCY	NOK	TOTAL NOK
FRF 9 062 454	9 234 513	
GBP 369 828	3 818 964	
DEM 83 513	204 135	
USD 148 040	755 478	
NOK	10 340 304	24 353 394

4.2.5 Cost Electrical

CURRENCY	NOK	TOTAL NOK
NOK	2 175 578	2 175 578

4.2.6 Cost Transportation

	TOTAL NOK
LIMATERMINALEN-SURFACE TRANSPORT	1 475 778
AIRBROKER-AIR TRANSPORT	173 326
MORY-CUSTOM CLEARANCE BORDEAUX	174 097

TOTAL EXPENSES EQUIPMENT & TRANSPORTATION	52 145 000
COST ACCOUNT 226 000	

4.3 EXPENDITURE AGAINST TIME

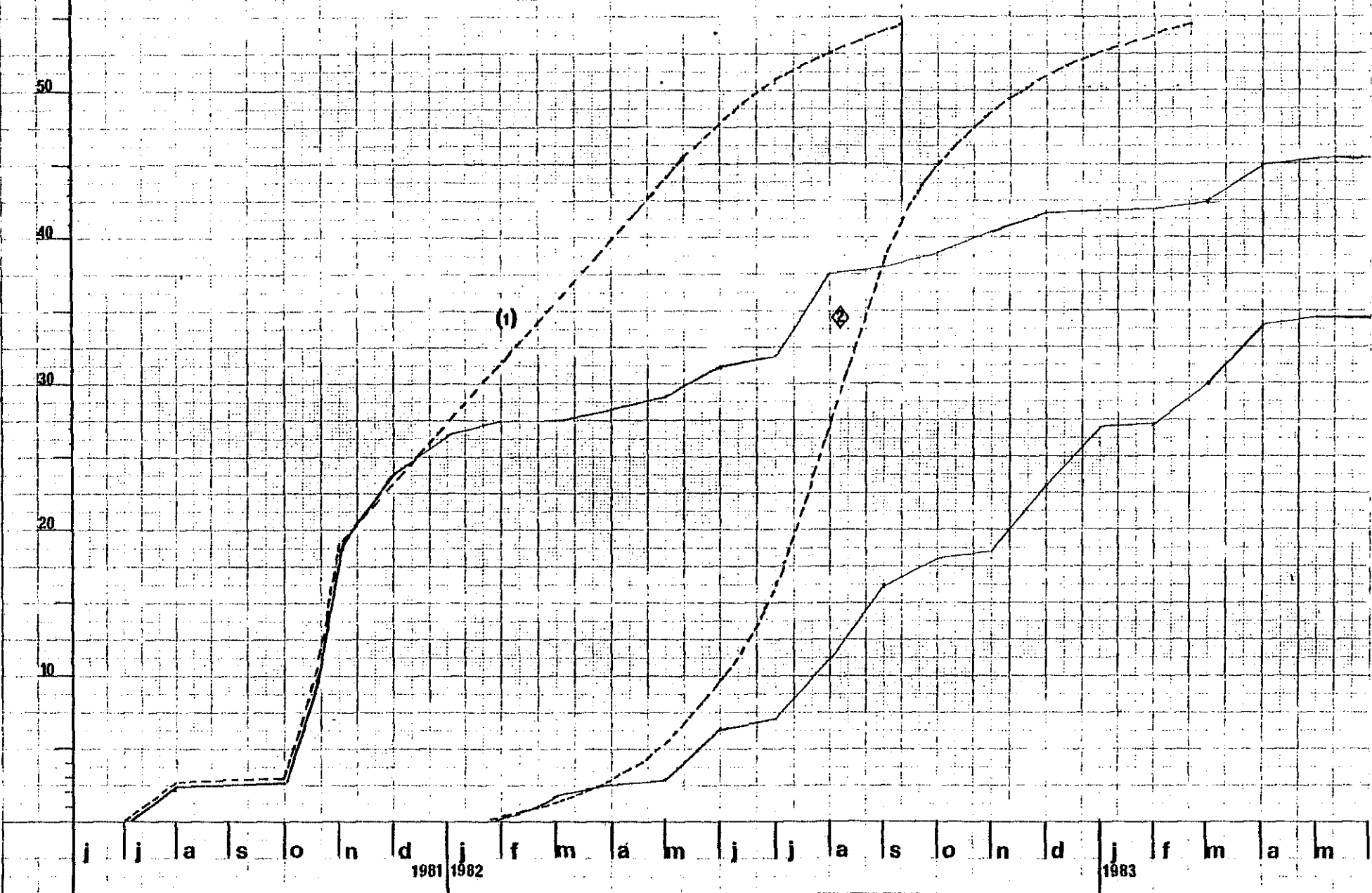
The Expenditure Against Time for the purchase orders placed by Sofresid Norge A/S is shown on figure 4.1.

M.Nkr

TCP-2 EXTENSION : PROCUREMENT

FIGURE 4.1

(1) Commitments (2) Payments : ----- forecast _____ actual



4.4 DELIVERY TIME

The average delivery times have been:

Instrumentation

Electronic + Pneumatic Instruments	26 WEEKS
Control Valves	52 WEEKS
Panels	26 WEEKS

Piping

Valves (Small)	26 WEEKS
" (Big)	52 WEEKS
Pipe and Fitting	20-60 WEEKS

Structural

Beams and Plates	20 WEEKS
------------------	----------

Electrical

Panels	40 WEEKS
Cable	30 WEEKS

Mechanical

Small Low Press Vessels	50 WEEKS
Small High Press Vessels	60 "
Big High Press Vessels	80 "
Pumps	40 "

5 YARD CONSTRUCTION

5.1 SUMMARY

In March 1982, Ponticelli Freres (PF) was awarded the Yard Construction Contract. The scope of work included construction of Module 50, Pancake 53, Piping Tie-In and later the temporary Pancakes 942 and 943.

The modules were completed and transported from Bordeaux to Stavanger end of April 1983.

The lump sum contract value was 31.630.500 FRF and the final contract value was 35.221.707 FRF. The temporary Pancakes 942 and 943 were not included in the lump sum. The value of these were 1.082.860, thus value of changes and main additional work were: 2.508.347 FRF or 8 % of the lump sum.

The final cost of the Budget Line "Construction" was 34.833 KNOK.

5.2 TENDER/BID EVALUATION

A summary of the Bid Evaluation is shown in Tables 5.1 and 5.2 and the detailed Bid Evaluation is shown in Appendix 2.

Ponticelli Freres (PF) in Bordeaux was awarded the contract.

TABLE 5.1

SPLIT OF MANHOURS ESTIMATE / SPLIT OF WEIGHT

Rev. 3-21.01.82/KM

Ex.rate-->	2.25				1.02			2.60	1.05
	HCG	HMV	KB	N/OFF	PON	SV	VIG	HDW	GØTA
Struct. Mhrs	51.440	40.945	37.665	48.680	64.000	38.675	48.980	38.071	42.100
Mhrs/ Ton	292	354	302	302	178	283	281	406	393
Mech. Mhrs	875	5.280	6.075	3.304	1.910	1.067	3.240	2.520	2.400
Mhrs/ Ton	197	265	520	227	161.1	281	276	326	498
Piping Mhrs	35.000	71.765	88.235	63.581	54.450	51.079	66.480	57.769	67.700
Mhrs/ Ton	280	283	392	331.5	227	277	277	284	341
Electr. Mhrs	7.125	6.325	5.945	2.845	6.800	5.938	2.990	5.835	5.100
Mhrs/ Ton	183	424	298	412	110	283	428	236	672
Instr. Mhrs	18.000	11.025	13.410	13.410	16.500	18.364	14.300	38.520	21.900
Mhrs/ Ton	301	509	396	471	274	286	414	241	344
Load & Seafas. Mhrs	14.950	13.245	15.800	17.590	14.400	6.862	12.460	7.495	3.900
Mhrs/ Ton	304	234	415	290	184	413	220	457	447
Total Direct Mhrs	127.390*	148.585	167.410	149.410	158.060*	121.985	148.450	150.210	143.100
1* Mhrs/ Ton	272	320	337	329	198	288	290	309	370
Service Mhrs	Incl. in dir.	36.295	32.700	35.520	16.000	23.398	40.000	15.668	13.000
2* Mhrs/ Ton	mhrs.	24%	20%	24%	10%	19%	27%	10%	9%
Management Mhrs	16.200	55.800*	51.000	49.920*	20.000	42.150*	44.000*	27.991	-
3* Mhrs/ Ton	13%	38%	31%	33%	13%	35%	30%	19%	-
Grand total Mhrs	143.590	240.680	250.850	234.850	196.060	187.533	232.450	193.869	-
4* Mhrs/ Ton	241	198	298	209	160	187	185	239	-
Lump Sum (KNOK)	34.607	47.610	74.829	49.112	31.316	35.145	43.002	46.388	52.920

* = Including forement

1* = Lump sum/productive mhrs

2* = Percent service mhrs of total productive mhrs.

3* = Percent management mhrs of total productive mhrs.

4* = Lump sum/grand total mhrs.

TABLE 5.2

SPLIT OF MANHOURS ESTIMATE / SPLIT OF WEIGHT

Rev. - 03.03.82/KM

	HCG*	HMV*	KB*	N/OFF*	PON*	SV*	VIG*	HDW*	GOTA*
Struct. Mhrs	51.440	40.945	37.664	48.680	64.000	38.675	48.980	38.071	42.100
Mhrs/ Ton	200.5	159.6	146.8	189.8	249.5	150.8	191	148.4	164.1
Mech. Mhrs	875	5.280	6.075	3.304	1.910	1.067	3.240	2.520	2.400
Mhrs/ Ton	6	36.2	41.7	22.7	13.1	7.3	22.2	17.3	16.5
Piping Mhrs	35.000	71.765	88.235	63.581	54.450	51.079	66.480	57.769	67.700
Mhrs/ Ton	112	229.6	282.4	203.5	174.2	163.5	212.7	184.9	216.6
Electr. Mhrs	7.125	6.325	5.945	2.845	6.800	5.938	2.990	5.835	5.100
Mhrs/ Ton	913.5	810.9	762.2	364.7	871.8	761.3	383.3	748.1	653.8
Instr. Mhrs	18.000	11.025	13.410	13.410	16.500	18.364	14.300	38.520	21.900
Mhrs/ Ton	336.4	206.1	250.7	250.7	308.4	343.3	267.3	720	409.3
Load & Seafas. Mhrs	14.950	13.245	15.800	17.590	14.400	6.862	12.460	7.495	3.900
Mhrs/ Ton	19.3	17.1	20.4	22.7	18.6	8.8	16.1	9.7	5
Total Direct Mhrs	127.390	148.585	167.410	149.410	158.060	121.985	148.450	150.210	143.100
Mhrs/ Ton	164.1	191.5	215.7	192.5	203.7	157.2	191.3	193.5	184.4
Service Mhrs	-	36.295	32.700	35.520	16.000	23.398	40.000	15.668	13.000
Mhrs/ Ton									
Management Mhrs	16.200	55.800	51.00	49.920	20.000	42.150	44.000	27.991	-
Mhrs/ Ton									
Grand total Mhrs	143.590	240.680	250.850	234.850	196.060	187.533	232.450	193.869	-
Mhrs/ Ton	185	310.1	323.2	418.6	252.6	241.6	299.5	249.8	

Weight in Ton:

	Module	Pancake	Total
Struct.	215.9	40.6	256.5
Mech.	123.5	22.3	145.8
Piping	288.3	24.2	312.5
Electr.	5.7	2.1	7.8
Instr.	49.3	4.2	53.5
Total	682.7	93.4	776.1

The above tabulation shows estimated mhrs for each trade divided with the weight estimate for the same trade.

Load out & Sea fastening, Total direct and Grand total are divided with total weight estimate.

* Abbreviations are explained overleaf.

Ref. Tables 5.1/5.2

Abbreviations

HCG = Hollandse Constructie Groep BV, Netherlands
HMV = Haugesund Mekaniske Verksted, Norway
KB = Kværner Brug A/S, Norway
N/OFF = Nordoffshore A/S, Norway
PON = Ponticelli Freres, France
SV = Stord Verft A/S, Norway
VIGOR = Vigor & Co. A/S, Norway
HDW = Howaldtswerke Deutsche Werft, Germany
GØTA = Gøtaverken Arendal, Sweden

5.3 ORGANIZATION OF THE WORK

5.3.1 Work Locations

The main works were performed on the following sites:

- Piping Prefabrication : June 1981 - December 1982
at LILLEBONNE (outside LE HAVRE)
- Structural Prefabrication: at AMBES (outside BORDEAUX) next to
Ponticelli main and drafting offices.
- Erection and outfitting : at BASSENS (outside BORDEAUX, 18 km from
(Ambes))

5.3.2 Main Subcontractors

- | | |
|-----------------------|-------------------------------------|
| - DUPIN | Sandblasting & Painting |
| - ROUBINET | id. |
| - PEINTURE NAVALE | id. (LE HAVRE) |
| - COMSIP/CGEE-ALSTHOM | Electrical / Instrumentation |
| - FORT | Prefabrication Secondary Structures |
| - SETT | id. |
| - I.C.A. | Stainless Steel Cladding |
| - AGMT | Galvanization |
| - GISOL | Insulation |
| - S.M.I. | Prefab. Pipe Supports (LE HAVRE) |
| - FOURE-LAGADEC | Post Heat Treatment (LE HAVRE) |
| - LETHILIER | id. (LE HAVRE) |

5.3.3 EAN Team

EAN had a team of approx. 10 persons located at the yards.
See yard organization chart on figure 5.3.

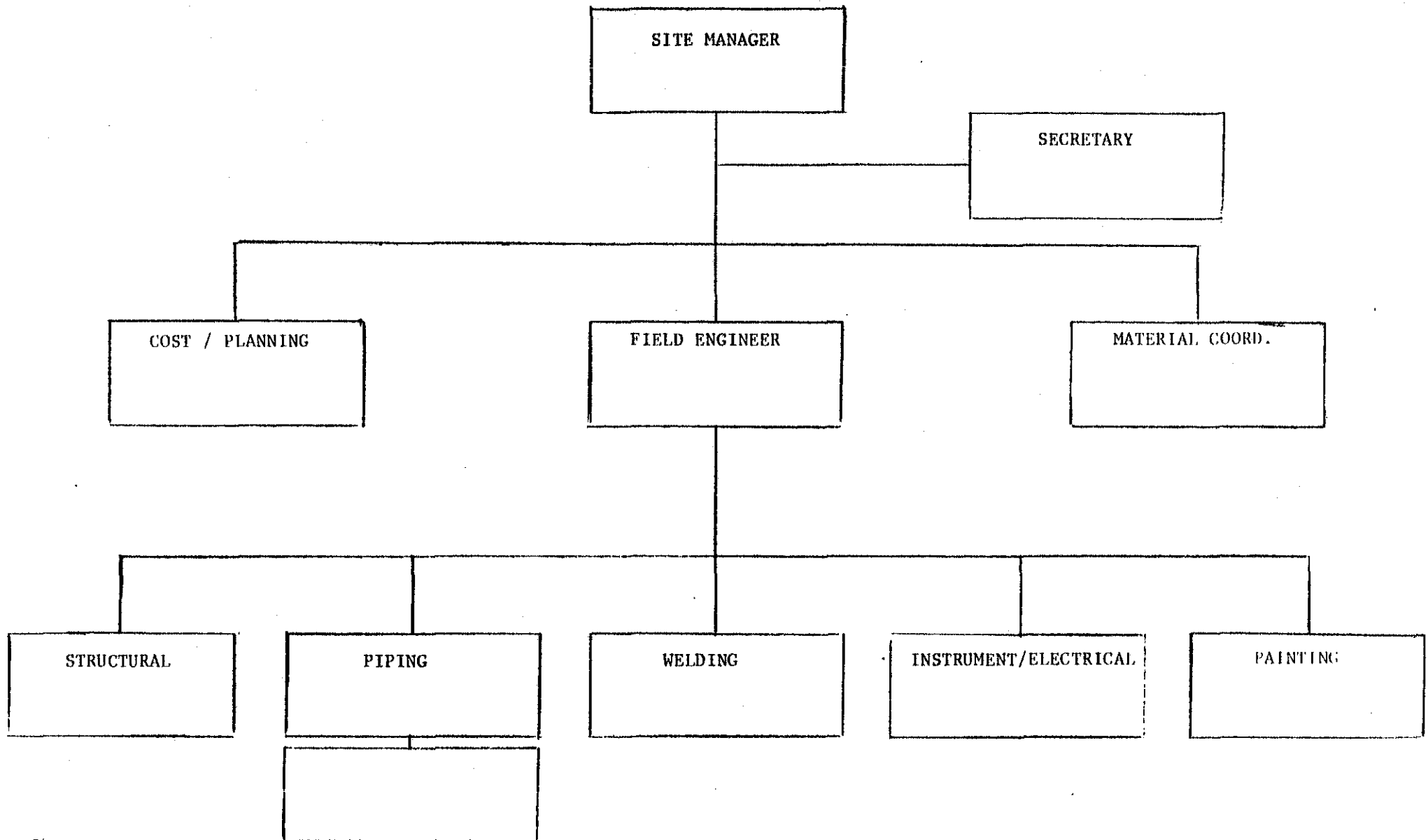


FIGURE 5.3

5.4 PLANNING AND PROGRESS

5.4.1 Planning -- Levels 1, 2 and 3

The contract planning Levels 1, 2, 3 were established during negotiation phase.

Level I planning : over project duration, about 25 activities split by module and discipline. (Figure 5.4)

Level II planning : over project duration, one for each module, about 50 activities split by discipline and main sub-assemblies. (Figure 5.5 and 5.6)

Level II network : over project duration, one for each module, gives precedence relations against a time schedule.

Level III planning: also 6 week look ahead, was a handmade planning derived from Level II network. It was drafted every time the critical path line changed, mainly for the following activities:

- A - Module 50 erection up to "box complete"
- B - Pancake 53 erection
- C - Piping erection, flushing, testing on Module 50
- D - Electrical and instrumentation works

5.4.2 Progress

Progress measured by activity was plotted on Level I and II plannings. It was obtained by means of weight factor related to completion of each work item.

The Progress Curve is shown on the schedules figures 5.4, 5.5 and 5.6.

The Weekly Overall Progress Report is shown on figure 5.7 and by Discipline on figure 5.8.

5.4.3 Examples

The following examples are enclosed.

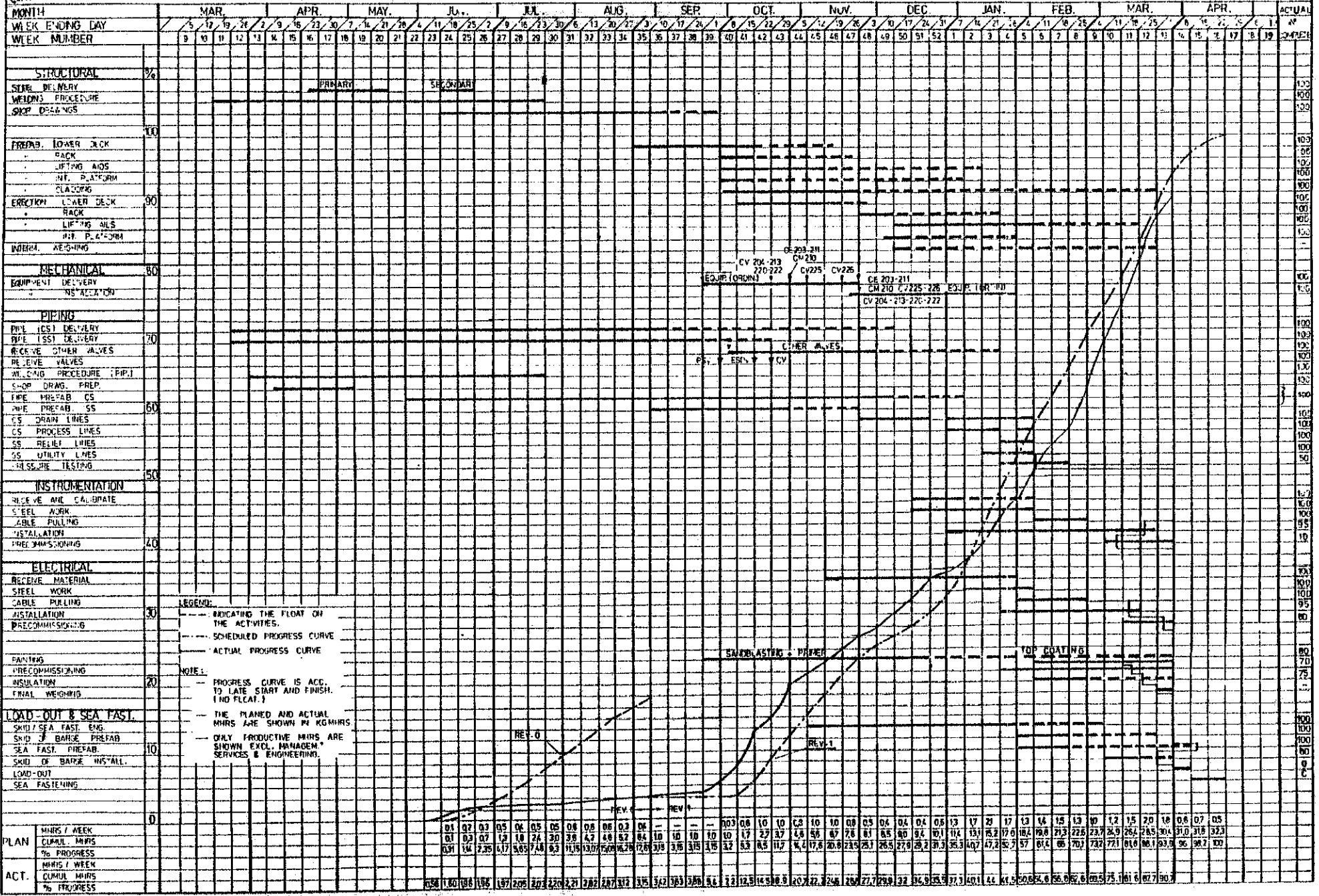
- Overall fabrication schedule and progress curve Figure 5.4
- Overall fabrication schedule and progress curve M.50 Figure 5.5
- Overall fabrication schedule and progress curve P.53 Figure 5.6
- Weekly progress overall Figure 5.7
- Detailed progress report Figure 5.8

PANCAKE 53 FABRICATION SCHEDULE.

LEVEL II PLANNING P53 - FIGURE 5.6

Date: 5.9.82 Rev: 1

CONTRACT F 125



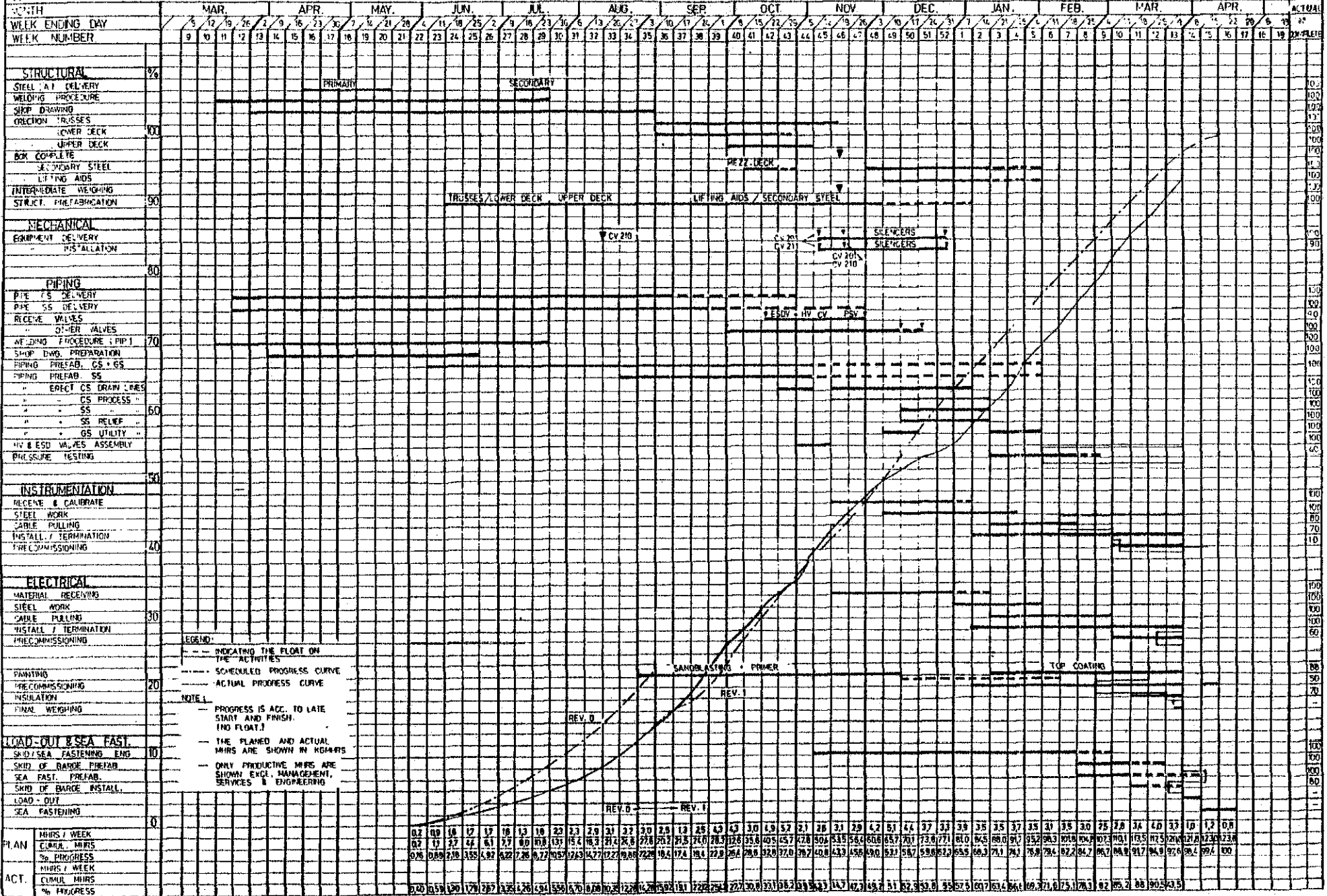
MODULE 50 FABRICATION SCHEDULE

LEVEL II PLANNING M50 - FIGURE 5.5

STATUS PER 31.03

CONTRACT F. 125

Date 39 82 Rev. 1



PROGRESS PER END OF WEEK : 9

	ACTUAL		SCHEDULED	
	THIS WEEK	GAIN THIS WEEK	LATE START THIS WEEK	GAIN THIS WEEK
OVERALL	79.26	4.09	84.3	2.2
M 50	81.97	3.71	86.7	2
P 53	69.45	6.87	73.2	3.1
T 80	77.62	—		

EXPENDED MHR'S THIS WEEK : 10.523

SCHEDULED EXPENDITURE THIS WEEK : 3.600

PROD. FACT. : 0.65

FORECASTED MANHOURS : 131.809

ACTUAL MANHOURS : 151.877

DETAILED PROGRESS REPORT

FIGURE 5.8

ACTIVITY		MHS	% WEIGHT	% COMPL.	WEIGHT COMPL
STRUCTURAL	SO 1 PREFAB TRUSSES	6280	5,07	100	5,07
	SO 2 LOWER DECK	4460	3,60	100	3,60
	SO 3 UPPER DECK	4620	3,73	100	3,73
	SO 4 MISCELLANEOUS	5510	4,45	100	4,45
	SO 5 LIFT AID	5240	4,23	100	4,23
	S 10 SUB-TOTAL	26110	21,08	100	21,08
	S 11 ERECT TRUSSES	6230	5,03	100	5,03
	S 12 ERECT LOWER DECK	4460	3,60	100	3,60
	S 13 ERECT UPPER DECK	5060	4,08	100	4,08
	S 14 ERECT MISCELLANEOUS	5900	4,76	100	4,76
	S 15 LIFT AID	4080	3,29	100	3,29
	S 16 WEIGHING	400	0,32	50	0,16
	S 20 SUB-TOTAL	26130	21,09	99,24	20,93
	S 30 TOTAL	52240	42,17	99,62	42,01
	PIPING	P 01 PREFAB PIPING	16000	12,92	100
P 02 ERECT PIPING		14000	11,30	100	11,30
P 03 TESTING		2000	1,61	100	1,61
P 40 TOTAL		32000	25,83	100	25,83
MECHANICAL	M 50 INSTALL	7150	5,77	100	5,77
ELECTRICAL	E 60 INSTALL	4000	3,23	100	3,23
INSTRUMENT	I 70 INSTALL	11000	8,88	100	8,88
COATING	C 80 PAINTING-INSULATION	9900	8,00	96,25	7,7
LOAD OUT	L 90 LOAD-OUT SEA FAST	7600	6,13	98	6,01
T 100 TOTAL		123890			
				% COMPLETE	99,42
				LAST % COMPLETE	97,40
				PROGRESS	2,02
<p style="text-align: center;">EAN M50</p> <p style="text-align: center;">WEEKLY PROGRESS REPORT</p>				WEEK	16
				DATE	22/04/83

5.5 COST

The final cost for Budget Line "Construction" was 34.833 KNOK. This consisted of the original lump sum, additional work and changes.

5.5.1 Lump Sum

The contract value of the lump sum was 31.630.500 FRF, and final lump sum paid was 31.217.058 NOK including escalation.

The lump sum was paid according to the following schedule:

- 5 % advance at the commencement date.
- Monthly payments according to the monthly progress reports - less 20 % retention until the advance payment had been amortised.
- When all advance payment had been amortised 10 % retention was deducted on the monthly invoices.
- The retained amount was paid upon provisional acceptance of the work and when Bank Guarantee was received.

The lump sum was split according to the following schedule:

Split of Lump Sum Price (in French Francs)

	Module 50	Pancake 53	Tie-In Spool
1. Structural			
1.1 Main Structure	7.692.900	1.165.700	
1.2 Other Structure	1.110.800	305.800	
1.3 Painting	584.940	160.040	
1.4 Weight Testing	45.000	30.000	
2. Mechanical			
2.1 Installation of Vessels and Equipment	200.100	95.700	
3. Piping			
3.1 Pre-Fabrication	4.563.500	941.950	1.729.590
3.2 Erection	2.901.000	642.000	
3.3 Hydrostatic Test and Flushing	261.000	60.900	140.000
3.4 Painting	306.900	66.000	80.850
3.5 Insulation	511.600	138.200	
4. Electrical	624.600	176.950	
5. Instrumentation	3.056.000	1.416.380	
6. Load Out	365.000	305.000	60.000
7. Sea Fastening	1.026.600	710.000	155.500
SUB TOTAL	23.249.940	6.214.620	2.165.940
TOTAL		31.630.500	

5.5.2 Changes

178 change orders were issued, and total amount accepted was 3.591.207 FRF; 3.616.000 NOK.

Excluding the pancakes 942 and 943 which amounted to 1.082.860 FRF, total value of changes were 2.508.347 FRF; i.e. 8 % of the lump sum.

The change orders were divided into the following categories:

Category "A" - Change orders covering a change relative to job as per contract. Issue of engineering drawing package.

Category "B" - Additional work implying no change to previously designed on manufactured equipment.

Category "C" - Purchase according to contract requirements or upon request.

Category "D" - Services, i.e. reimbursement of telephone, telexes etc.

The major change orders were:

C.O. 003: Extra welds on pipe material delivered in length of 2 m instead of 6 m.

Value: 228.643 FF

C.O. 008: Extra work involved with the welding of pup pieces to the Mapegaz valves.

Value: 90.960 FF

C.O. 014: Sandblast and primer on supplied structural steel; which was originally primed in steel factory but proven to be of bad quality.

Value: 96.900 FF

C.O. 017: Sealing plates on main beams; designed nodes on main beams did not facilitate corrosion protection. Decision was taken to seal off.

Value: 43.191 FF

C.O. 032: Fabrication of pancakes 942, 943. Not included
& 033: in original scope.

Value: 1.082.860 FF

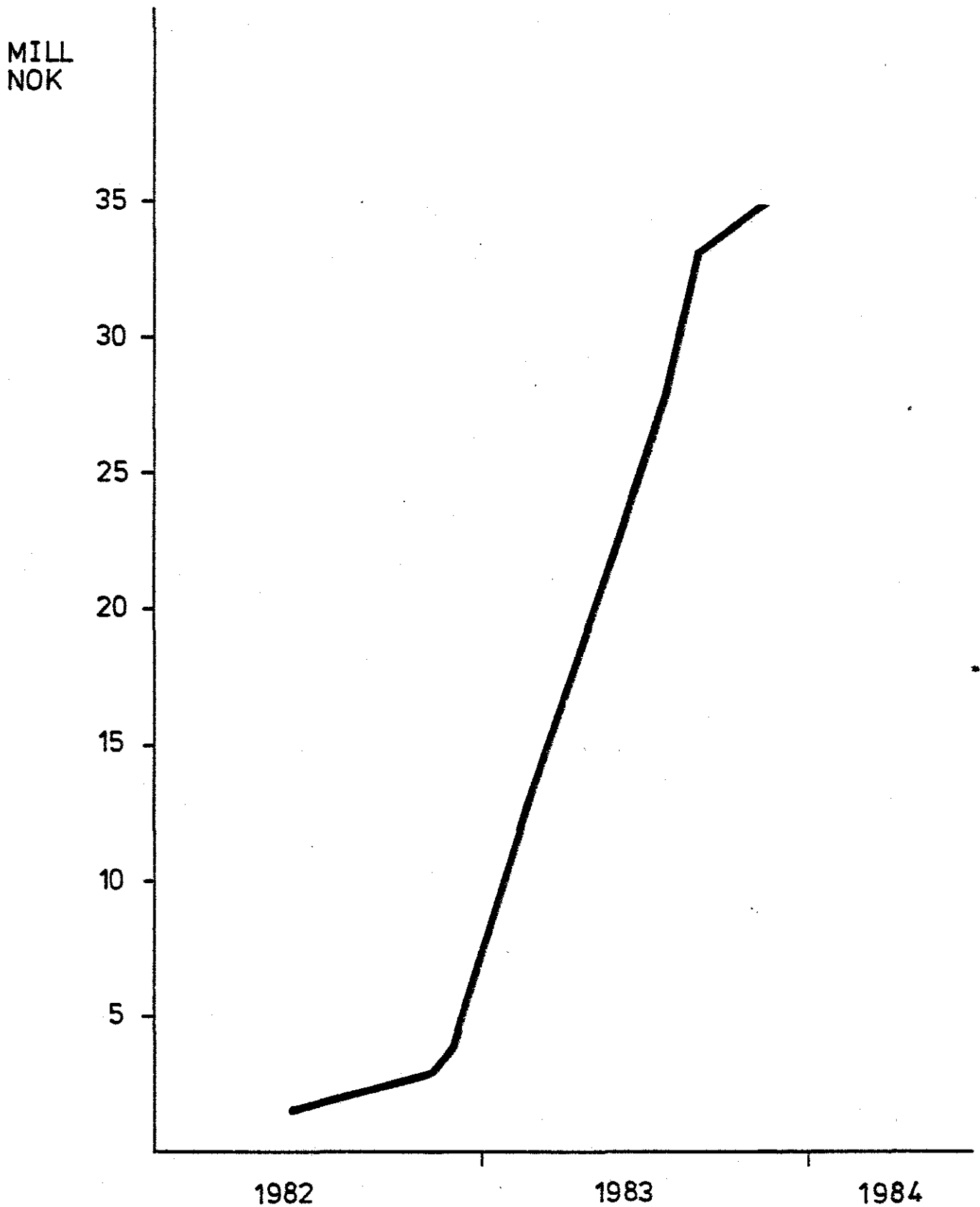
- C.O. 034: Rejection of 12" pipe class EFS. Spools already prefabricated to be started again.
Value: 223.932 FF
- C.O. 048: Change lifting platform. To increase the laid down area for slings and access: Request from lifting contractor.
Value: 201.208 FF
- C.O. 070: Fabrication of tie-in plates for connection of M50 and P53 to adjacent installation on platform. Not included in lump sum price due to lack of information.
Value: 150.157 FF
- C.O. 072: Fabrication of bumpers, guides etc. - Not included in
& 112: lump sum price due to lack of information.
Value: 151.048 FF
- C.O. 086: Additional heat tracing and insulation. Not specified
& 111: in engineering documents.
Value: 236.915 FF

5.5.3 Expenditure Against Time

Total amount paid was 34.833 KNOK, and expenditure against time is shown on figure 5.9.

EXPENDITURE AGAINST TIME CONTRACT F.125 CONSTRUCTION

FIGURE 5.9



5.6 EXPENDED MANHOURS

ACTIVITY	PLANNED MHS	REAL MHS	<u>PLANNED</u> <u>REAL</u>
M 50	115.890	155.659	0.74
P 53	26.670	38.746	0.69
T 80	9.600	10.495	0.91
LOAD OUT/WEIGHTING/SEA-FASTENING	14.200	12.580	1.13
TOTAL PRODUCTIVE HRS	166.360	217.480	0.76
"NON PRODUCTIVE HRS" (According to contract estimate)		22.220	
TOTAL SCOPE OF WORK		239.700	
EXTRAS		11.928	

MANHOUR CONSUMPTION AT PONTICELLI FRERES
SUMMARY SHEET

- Planned mhrs : Manhour consumption according to contractual estimate.
 Real mhrs : Manhours spent during fabrication.
 Planned/Real : Ratio between planned and expended manhours.

MANHOOR CONSUMPTION MODULE - 50

ACTIVITY		PLANNED MHS	REAL MHS	<u>PLANNED</u> <u>REAL</u>
STRUCTURAL	PREFAB TRUSSES	6.280	9.672	0.65
	LOWER DECK	4.460	3.171	1.41
	UPPER DECK	4.620	4.913	0.94
	MISCELLANEOUS	5.510	4.416	1.25
	LIFT AID	5.240	7.314	0.72
SUB TOTAL PREFAB.		26.110	29.486	0.89
	ERECT TRUSSES	6.230	4.480	1.39
	ERECT UPPER DECK	5.060	6.837	0.74
	ERECT LOWER DECK	4.460	7.623	0.59
	ERECT MISCELLANEOUS	5.900	15.107	0.39
	LIFT AID	4.080	4.622	0.88
SUB TOTAL ERECTION		25.780	38.669	0.67
TOTAL STRUCTURAL		57.840	68.155	0.76
PIPING/ EQUIPMENT	PREFAB PIPING	1.600	12.828	1.25
	ERECT/TEST	23.150	36.308	0.58
	TOTAL	39.150	52.641	0.74
ELECTRICAL/ INSTRUMENT	INSTALLATION	15.000	25.583	0.59
COATING	PAINING- INSULATION	9.900	9.280	1.07
	TOTAL	115.890	155.659	0.74

MANHOOR CONSUMPTION PANCAKE - 53

	ACTIVITY	PLANNED MHS	REAL MHS	<u>PLANNED</u> <u>REAL</u>
STRUCTURAL	PREFAB	4.830	3.743	1.29
	ERECT LOWER DECK	2.200	3.611	0.61
	ERECT PIPERACK	400	747	0.54
	ERECT LIFTING AID	990	1.124	0.88
	ERECT INT PLATFORM	200	65	3.08
	TOTAL - ERECT	3.790	5.547	0.68
	TOTAL - STRUCT	8.620	9.290	0.93
PIPING/ EQUIPMENT	PREFAB PIPING	4.700	2.673	1.76
	ERECT/TEST	4.450	10.999	0.40
	TOTAL	9.150	13.672	0.67
ELECTRICAL/ INSTRUMENT	INSTALLATION	6.500	12.032	0.54
COATING	PAINTING	2.400	3.752	0.64
	TOTAL	26.670	38.746	0.69

MANHOUR CONSUMPTION TIE-IN

ACTIVITY		PLANNED MHS	REAL MHS	<u>PLANNED</u> <u>REAL</u>
PIPING		7.700	4.491	1.71
TESTING/ PACKAGING		1.400	5.480	0.26
COATING	TOTAL	500	524	0.95
TOTAL		9.600	10.495	0.91

5.7 WEIGHTS

ITEM	MODULE 50 TONS	PANCAKE 53 TONS	TIE-IN TONS
ELECTRICAL	10.0	5.0	
INSTRUMENT	30.0	3.0	
MECHANICAL	123.5	19.0	
CM 210		5.3	
PIPING	318	18.4	79
STRUCTURE	251.0	41.5	8
LIFTING FRAME	79.0	14.5	
TOTAL	812.0	106.7	87
<u>WEIGHTING RESULT</u>			
PRIOR TO LOAD-OUT	799.0	99.0	NOT PERFORMED

Weights based upon Ponticelli's weight is estimated dated March 1983.

5.8 RATIOS

The following ratios have been derived:

5.8.1 Structural

<u>MODULE</u>	<u>M 50</u>	<u>P 53</u>
Struct. Weight	294 T	54 T
Prefabrication MH	29.486 MH	3.743 MH
Prefabrication H/TOM	100 H/T	70 H/T
Erection MH	38.669 MH	5.547 MH
Erection MH/TOM	132 H/T	103 H/T
Total MH	68.155 MH	9.290 MH
Total MH/TOM	232 H/T	173 H/T
Projected area	248 sq.m	156 sq.m
Struct.weight excluding lifting aids	215 T	40 T
Struct.weight per proj.sq.m	0,87 T/M	0,26 T/M2

5.8.2 Piping Prefabrication

<u>Module</u>	<u>Total</u>	<u>M50</u>	<u>P53</u>	<u>Tie-In</u>
Prefabrication weight*	287 T	190 T	18 T	79 T
Nb isometrics/spools	282	144 iso	49 iso	89 spools
Manhours total hrs	19.992	12.828	2.673	4.491
<u>Productive manpower</u>				
Welders + fitters mhrs	14.216	9.120	1.896	3.200
Manday	1.777	1.140	237	400
Number of butt welds N	3.796	1.971	1.172	(653) **
Average diameter D	4.4 in	5.9	2.6	(3.2)
Average thickness e	13.3 mm	17.3 mm	5.2 mm	(3.12 mm)
Welding length <ND	16.840 in	11.614 in	3.089 in	(2.137 in)
Welding quantity <NDe	224.292 in mm	201.486 in mm	16.131 in mm	6.675 in mm
<u>Productive ratio MHRS</u>				
Per ton	50	48	105	40
Per iso		63/iso	39/iso	36/spool
<u>Productive ratio per manday</u>				
Welding length:	9.5 in/m.d	10.2	13	(5.3)**
Welding quantity:	126 in mm/ m.d	176	68	(16.7)

Note *: Piping weight includes pipe and fittings; does not included valves and supports.

Note **: Welding ratio for tie-in spools are out of range because compared to M50 and P53 quantity of welds is much lower (i.e. pipe cut and bevelled only for transportation to field).

5.8.3 Piping Erection

<u>Module</u>	<u>Total</u>	<u>M50</u>	<u>P53</u>
Erection weight *	377 T	355 T	33 T
Nb isometrics/spools	193 iso	144 iso	49 iso
Total Manhours	30.954	24.234	6720
<u>Productive manpower</u>			
MHRS	27.500	21.660	5.840
Manday	3.375	2.645	730
Number of sock.welds	1.040	880	160
Number of butt welds**	264	244	20
Average diameter		3.85 in	Not applicable***
Average thickness		14.4 mm	"
Welding length		4.330 in	"
Welding quantity		62.664	"
<u>Productive ratio MHRS</u>			
Per ton	73	61	265
Per iso	142	150	120
<u>Productive ration per Manday</u>			
Welding length:		16 in m.d.	
Welding quantity:		23 in mm/m.d.	
Ratio socket/butt welds		360 %	

Note * : Erection weight includes valves and pipe supports.

Note ** : Welds to be cut as consequence of clashes, repairs etc. are considered in productive manpower, but not recorded on number of welds.

Note ***: P53 and M50 figures can not be compared because M50 pipe is mainly high pressure class for gas process, and P53 is low pressure class for condensates process, together with numerous bolted connections.

5.8.4 Piping Test, Flushing, Preparation for Testing

<u>Module</u>	<u>Total</u>	<u>M50</u>	<u>P53</u>	<u>Tie-In</u>
Piping weight		355	22	79
Nb isometrics/spools		144 iso	49 iso	89 spools
Nb of test systems		49	43	21
Manpower (productive)				
MHRS		9.936	3.264	4.368
Manday		1.242	408	546
<u>Productive ratio in mandays</u>				
Per ton		3.5	18.5	6.9
Per iso or spool		8.6/iso	8.3/iso	6.1/spool
Per test system		25	9.5	26

Note : Test operations were time-consuming mainly for three reasons:

- 1 - Flushing was carried out with conventional circulation of water inside each "test system" pipes, where Contractor could have saved time and money by flushing with a mobile jet tool.
- 2 - Preparation for testing was long and fastidious due and not very well planned in advance
- 3 - Contractor had to present all fabrication records in the form described in the Completion File Manual prior to executing the hydrotest. This was a tuff procedure, but appeared to be the only way to the the Completion File ready and submitted when Modules are shipped.

6 TRANSPORTATION AND LIFTING

The total cost of the Budget Line Transportation and Lifting was 21.993 KNOK.

This consisted of the Transportation Contract to Neptun Transport & Marine Services A.B., the Lifting Contract to K/S Heerema Seaway A/S and different minor other contracts.

6.1 TRANSPORTATION

The Transportation Contract was awarded to Neptun Transport & Marine Services A.B. (NT) from Sweden. The Contract scope included delivery of cargo barge, towing from Bordeaux to Stavanger, stand by in Stavanger and towing to Frigg field.

6.1.1 Schedule

Barge delivery at Bordeaux	:	10 March 1983
Towing from Bordeaux started	:	20 April 1983
Arrival in Stavanger	:	4 May 1983
Towing from Stavanger to Frigg:	:	22 May 1983
Barge demobilization	:	31 May 1983

6.1.2 Cost

The total cost for the Transportation Contract - Contract F.177 - NT was 2.840 KNOK.

The amount was paid according to the following schedule:

- 1.200 KNOK - Advance payment on 01.01.83 accompanied by a contractor supplied Banker's Guarantee.
- Monthly payments according to the progress of the work.

6.2 LIFTING

6.2.1 Summary

In April 1982 the Lifting Contract was awarded to K/S Heerema Seaway A/S for a lump sum of 7.205.000 DLF equivalent to 18.368 KNOK.

Scope of work included; Engineering, Cleaning and Preparation Work and Lifting work on the Frigg field.

The total final cost for the Lifting works were 18.583 KNOK.

6.2.2 Tender Bid Evaluation

Bids from K/S Heerema Seaway A/S (HS) and McDermott International Inc. (MCD) were received on March 25th 1982. ETPM declined on the ground that ETM 1601 is not available in 1983.

HS was selected, and the detailed Bid Evaluation is shown in Appendix 3.

6.2.3 Planning

The Planning of the services is shown on figure 6.1.

6.2.4 Cost

The total cost of the Lifting Contract - Contract No. F.139 - K/S Heerema Seaway A/S (HS), was 18.583 KNOK (including additional work)

The lump sum was 7.205.000 DFL, according to the following breakdown:

Task Price

Task No. 1	:	Seafastening Engineering	DFL	130.000
Task No. 2	:	Not applicable		NA
Task No. 3	:	Not applicable		NA
Task No. 4	:	Lifting Engineering	DFL	260.000
Task No. 5	:	Platform Preparation	DFL	300.000
Task NO. 6	:	6A : Mobilization	DFL	1.750.000
		6B : Lifting Programme	DFL	3.015.000
		6C : Demobilization	DFL	1.750.000

The lump sum was paid at an exchange rate equivalent to 2.5494; 18.368 KNOK.

Additional work included crane operators, extra time spent on sea-fastening, extra work on P53 and P943 and stand by for hot work, amounted to 215 KNOK.

6.3 OTHER CONTRACTS

Other minor contracts and purchase orders amount to 570 KNOK.

7 HOOK UP AND INTEGRATION

The total cost of the Budget Line Hook-Up and Integration was 42.251 KNOK. This consisted of the Pre-Hook-Up works, the Hook-Up and Commissioning works and other minor contracts.

7.1 PRE-HOOK-UP

7.1.1 Summary

From the early stage of the project some works were separated from the original hook up scope in order to be performed in advance, these works were called pre hook up works. They were sub-contracted by the project to the Offshore Construction Department for realisation. The Platform Management Manual Procedure No. 15 was followed and the works were defined and split under different Modification Requests regarding:

- the time of requested completion
- the budget allocation
- the operational problems

The Modificaton Requests can be grouped in 3 sections:

A. Works on the Risers TCP-2 - Column 5.

- MR 88007 - Installation of ODIN pig-trap (temporary).
- MR 88004 - Extension of ODIN and NEF risers.
- MR 88005 - Installation of NEF pig trap (temporary).

B. Works on TCP-2.

- MR 88009/MR 88012 - Cleaning and preparation of the platform prior to lifting.
- MR 88010 - Installation of MCCA and B.
- MR 88011 - Extension of P.A. system
- MR 40004 - Inst. of ODIN Telecom/Teletrans.
- MR 60016 - Inst. of NEF Power Supply.
- MR 60017 - Inst. of NEF Teletrans.

C. Works on DP-2.

- MR 88007 - Reconnection of 4" line between TCP-2 and DP-2.

The total cost of the pre-hook-up works was 2.926 KNOK.

7.1.2 Work Orders / Planning

7.1.2.1 Extension of R5E-16" NEF and R6E-20" ODIN Risers (MR 88004)

Scope

The scope of work was defined as follows:

- prefabrication of spool pieces
- offshore installation
- pressure testing

Schedule

Modification request approved	: 17.11.81
Call for bid	: January '82
State of commitment and work order	: 15.02.82 (WO-OCD TCP2-175)
Selected contractor	: CON-ECOSSE CO. LTD
Start date	: 22.02.82
Completion date	: 22.03.82
Lump sum	: 545.500 NOK
Manhours	: Total for all Mod.Req. described under 6.1. is about 2.200 mhrs.

7.1.2.2 Cleaning and Prep. of the Platform before Lifting (MR 88009/88012)

Scope

- Removal of lighting fixtures installed in pancakes southern part of TCP-2, and in Module M01.
- Cleaning of P962.
- Rerouting/Removal of electrical/instrument wires connected to the equipment removed.
- Storage of removed items in view of future reinstallation.

Schedule

Call for bid : 14.02.83
Work order : 10.03.83 (W.O. OCD - TCP2 218)
Selected contractor : Roco - Inspection A/S
Offshore starting date : 12.03.83
Offshore completion date : 28.03.83
Number of manhours : 1824 mh.

7.1.2.3 Extension of MCC A and MCC B (MR 88010).

Scope

The scope of work was defined as follows:

- Installation of Extension of MCCA and B and tie-in with existing MCC's.
- Installation of DB 321 "Normal Lighting Panel" with power supply line from MCC A/B.
- Installation of DB 322 "Maintained Lighting" panel with power supply line from existing cabinet S 53.44.3.9.
- Installation of DB 324 "Emergency 24 DC" panel with power supply line from existing DB 310.

The work also covered all control lines to and from existing equipment.

The work included pre-commissioning of all the installation but final commissioning was reserved to hook up responsibility.

Schedule

Call for bid : 14.02.83
Work order : 14.03.83 (W.O. OCD TCP2 220)
Selected contractor : P.S. Contractor
Offshore starting date : 07.04.83
Offshore completion : 10.06.83
Number of manhours : 1672 mhrs.

7.1.2.4 Extension of PA System (MR 88011).

Scope

The scope was defined as follows:

- Installation of cable trays, from interface room to M50/P53 areas and inside interface room.
- Modification on existing public address cabinet.
- Installation of cable transits.

The only work left for hook up was:

- Tie-in of cable on one and into existing systems.
- Connection on M50 and P53 when arrived.
- Testing.

Schedule

Call for bid	:	02.02.83
Work order	:	01.03.83 (W.O. OCD TCP2 219)
Selected contractor	:	GMC Electro A/S
Offshore starting date	:	15.03.83
Offshore comp. date	:	29.05.83
Number of manhours	:	1261 mhrs.

7.1.2.5 Odin Telecom/Teletrans (MR 40004)

Scope

The scope of work was the following:

- Installation of ODIN cabinets in QP platform.
- Installation of QP tower.
- Installation of electrical power supply for those.
- Connection and tie-in of the control cables.
- The final commissioning was not included in the scope and reserved for the hook up.

Schedule

Call for bid	:	02.02.83
Work order	:	01.03.83 (WO OCD TCP2 219)
Selected contractor	:	G.M.C. Electro A/S
Offshore starting date	:	15.03.83
Offshore compl. date	:	29.05.83
Number of manhours	:	578 mhrs.

7.1.2.6 NEF Power Supply (MR 60016).

Scope

- Structural modifications inside old work shop for use as high voltage room.
- Modification in HVAC system.
- Installation of high voltage equipment (transformers, breakers, cells)
- Installation and connection of high voltage cables.
- Installation and tie-in of control cables into existing equipment.

Schedule

Call for bid : 25.02.83
Work order : 28.03.83 (WO TCP2 OCD 221)
Selected contractor : P.S. Contractor
Offshore starting date : 15.04.83
Offshore completion date : 27.06.83
Number of manhours : 6564 mhrs.

7.1.2.7 NEF Teletrans (MR 60017).

Scope

- Installation of cabinets in QP platform.
- Installation of antennas in QP tower.
- Installation of cable transits.
- Pulling and connection of control and power cables.

Pre-commissioning of installation was part of the scope but commissioning was NEF project responsibility.

Schedule

Call for bid : 02.02.83
Work order : 01.03.83
Selected contractor : GMC Electro
Offshore starting date : 15.03.83
Offshore completion date : 29.05.83
Manhours : 762 mhrs.

7.1.3 Cost

Pre Hook Up work were split on the following Modification Requests:

- MR 88004 - Extension of R5E-16" NEF and R6E-20" ODIN risers.
Con-Ecosse Co. Ltd.
Total cost: 545.500 NOK
- MR 88009 - Cleaning and preparation of the platform before lifting.
Roco - Inspection A/S
Total cost: 351.600 NOK
- MR 88010 - Extension of MCC A and MCC B.
P.S. Contractors A/S.
Total cost: 301.200 NOK
- MR 88011 - Extension of PA System
GMC Electro A/S.
Total cost: 405.100 NOK
- MR 40004 - ODIN telecom/teletrans.
GMC Elektro A/S
Total cost: 177.800 NOK
- MR 60016 - NEF Power Supply
P.S. Contractors A/S
Total cost: 902.400 NOK
- MR 60017 - NEF Teletrans.
GMC Electro A/S
Total cost: 241.700 NOK

Total cost Pre Hook Up = 2.925.700 NOK

7.1.4 Expended Manhours

Total manhours spent in pre hook up : 12.661 mh

The hours spent in diving operations and extension of the risers are not included.

7.2 HOOK UP AND COMMISSIONING

7.2.1 General

A contract covering all Hook-Up works and provision for Commissioning Assistance was awarded to Haugesund de Groot Offshore A/S & Co. (HDG) in March 1983. The value of the lump sum contract was 25.5 MNOK.

In addition Unit Prices and Unit Manhour Rates were included to cover additional work changes and commissioning assistance. The final value of the HDG contract was 33.724 KNOK.

7.2.2 Tender / Bid Evaluation

6 companies were sent tenders for the Hook-Up contract:

- Aker Contracting A/S
- Haugesund de Groot Offshore A/S & Co.
- McDermott Norge A/S
- Spie Batignolle
- U.I.E. Norge A/S
- Oil Industry Services A/S

Bid Evaluation

This was done in 2 steps:

1st step: Comparison of the 6 bids and selection of the 2 best ones.

2nd step: Comparison of the 2 last contractors after giving them additional information.

Haugesund de Groot Offshore A/S & Co. was selected and a summary of the Bid Evaluation is given in table 7.1.

TABLE 7.1

TCP-2 EXTENSION HOOK-UP

CONTRACT F.142

BASIS FOR PRE-SELECTION

DESCRIPTION		O.I.S.	HAUGESUND DE GROOT	U.I.E NORGE	AKER CONTRACTING	MC DERMOTT	SPIE BATIGNOLLE
Original offer:	Lump sum tasks	30.129	22.166	30.874	30.838	37.359	34.771
	Mobilization	2.800	2.375	3.430	2.870	1.758	3.897
	Total	32.929	24.541	34.304	33.645	39.117	38.668
Adjustments:	Tasks						
	Mobilization						
	Qualifications/Except.						
	Total						3.615
Additional work:	Unit rate 10.000 MHRS	4.019	2.125	2.761	2.171	3.590	2.555
	Unit prices (4MNOK basis)	7.482	5.624	6.656	4.396	6.767	8.393
	Equipment	788	499	859	409	636	1.746
	Stand by 5000 MHRS.	995	910	1.000	1.095	1.575	1.245
	Total	13.284	9.158	11.276	8.071	12.568	13.939
	Grand Total	46.213	33.699	45.580	41.716	51.685	48.992
	Norwegian Content	100	97	95	100	98	92

Rev. 1

20/2-83.

7.2.3 Organization of the Work

The Hook-Up, Precommissioning and Commissioning have been managed by EAN - TCP-2 Extension Department.

The preparation started in March '83 and the work was completed in October '83 for both Hook-Up and Commissioning work.

The overall schedule of the work was based on the three following milestones:

- A. Platform ready for gas in 15/08
- B. Safety system automatically operational on the whole platform including the new module and pancake two weeks after start of the works.
- C. Power Supply to NEF FCS operational for the 10.07.83.
- D. Start Up in November/December.

Hook Up Preparation

Phases

- Hook up bid package (1st draft for comments) : Aug. '82
- Hook up bid package (final) : Mid Oct. '82
- Final definition of pre hook up scope of work : June '82
- Call for tender issue : Nov. '82 (15th)
- Bids received : Jan. '83 (18th)
- Contract awarded : March '83 (31st)
- Selected contractor in our offices in Dusavik for common prep. : Apr. '83 (15th)
- Updated HU package with additional infos. : May '83 (29th)

Presentation of the Work - Task Preparations

The work was split into the 5 major disciplines:

- Structural (including painting)
- Piping (including insulation)
- Mechanical
- Electrical
- Instrumentation

The work in those disciplines were split and defined by tasks; each task supported by a task sheet. Each task sheet contained all necessary information for:

- Performance of the work itself
- Computerized follow up.

Information Related to Preparation of the Work

- Scope of the work
- Material list
- Drawing and specification references
- Area location (with sketch)
- Extra information such as crane access, if cold or hot work etc.

7.2.4 Planning and Progress

7.2.4.1 Planning

A network planning of the Hook-Up works was prepared on the Artemis computer system.

The network consisted of 700 activities, each activity being a task. Three levels of planning was worked out:

- Level I by major milestones
- Level II by system/sub-systems
- Level III by detailed tasks

Level II Bar Chart is shown in Appendix 4 and an example of Level III is also given.

An Overall S-Curve on an S-Curve by discipline was then established.

The Overall S-Curve is shown on figure 7.2, and the S-Curves by discipline is shown in Appendix 5.

Based upon the completion dates of the tasks and the overall milestones given in 7.2.3 a commissioning planning was established (Figure 7.3).

7.2.4.2 Progress

Each task was represented by a certain "weight" corresponding mainly to the direct manhours estimate. The multiplication of the progress of the work by the weight of the task allowed to measure the progress; this was done for each task. The progress was available on the 3 previous planning levels, with, in addition "by discipline" planning.

The overall progress measurement was shown on the S-Curve. (Figure 7.2).

The cumulative manhours by discipline is shown in Appendix 6.

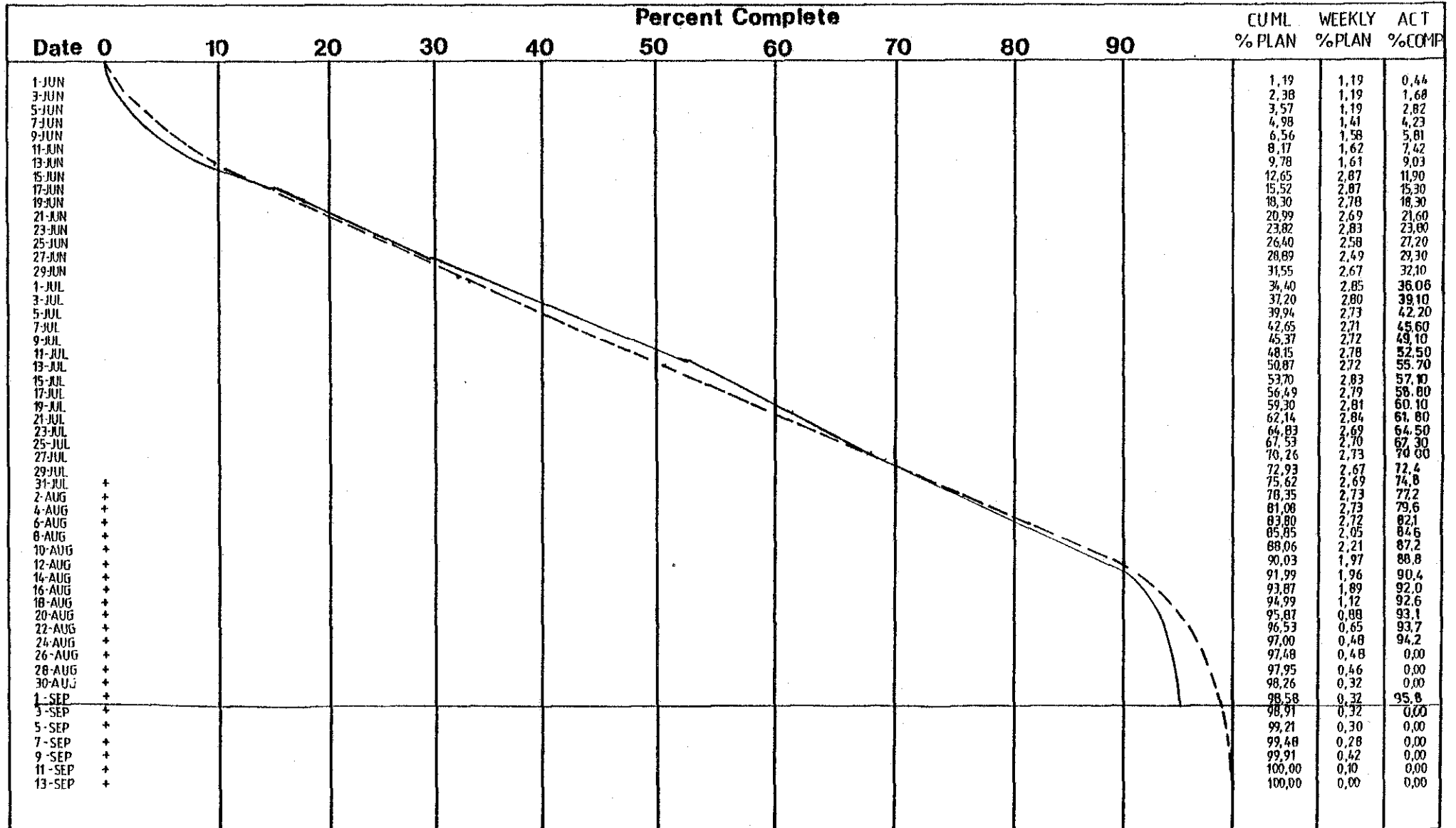
Elf Aquitaine Norge a/s Frigg TCP2 Extension
 Project by Haugesund deGroot
 ID:50 Project:TCP2

Project S Curve
 Report Number: TCURV

RUN DATE 31-AUG-83
 SORTED BY PLANNED START
 DATASET: CURVE 1

TOTAL

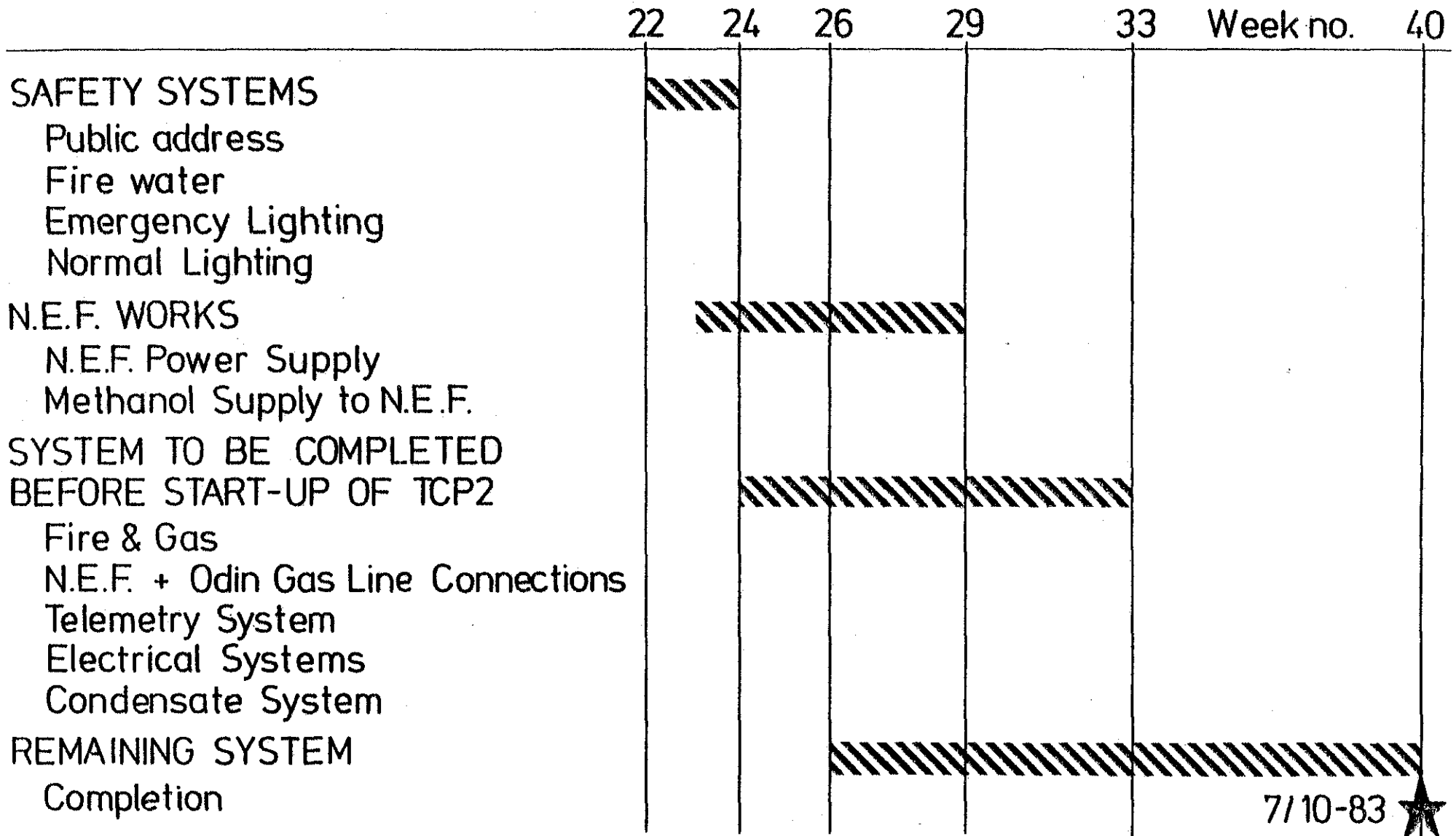
FIGURE 7.2



----- Planned accumulated percentage completed per date

————— Actual percentage completed per date

TCP2 Extension Milestone Plan



7.2.5 Cost

The project's share of the major Hook-Up, Contract No. F.142 - (Haugesund de Groot Offshore A/S & Co.), was 33.724 KNOK. This consisted of the lump sum, additional work changes, commissioning assistance and stand by.

7.2.5.1 Lump Sum

The lump sum was split up in approx. 700 tasks, totally amounting to:

	22.277.655 NOK
+ mobilization fee	<u>3.112.921 NOK</u>
Total Lump Sum	<u>25.390.576 NOK</u>

Original Lump Sum Tasks, totally amounting to 562.658 NOK were reallocated to NEF, and the total Lump Sum Cost was thus reduced to 24.827.918 NOK.

The Lump Sum was paid according to the following schedule:

- 10 % advance payment at contract award accompanied by contractor supplied Bank Guarantee.
- Mobilization fee at commencement date.
- Monthly payments based upon progress reports.
- Semi-monthly payments for completed tasks.
- Retention with-held on monthly and semi-monthly payments, paid after final acceptance.

7.2.5.2 Additional Work-Changes

476 change orders were issued, and the total amount approved for change order work was 6.988.794 NOK. (Excluding Commissioning, Stand by and other parties share).

This amounts to 28% of the Lump Sum.

7.2.5.3 Commissioning Assitance

58 change orders were approved for Commissioning Assitance, totally amounting to 1.535.419 NOK; 6 % of the Lump Sum.

7.2.5.4 Stand By

4 change orders caused by stand by were approved, and the project's share of these was 371.898 NOK.

The stand by was either caused by bad weather conditions or operational requirements.

7.2.5.5 Other Parties Share

The total part of the Hook-Up Cost reallocated to other parties was 1.313.460 NOK.

These were split as follows:

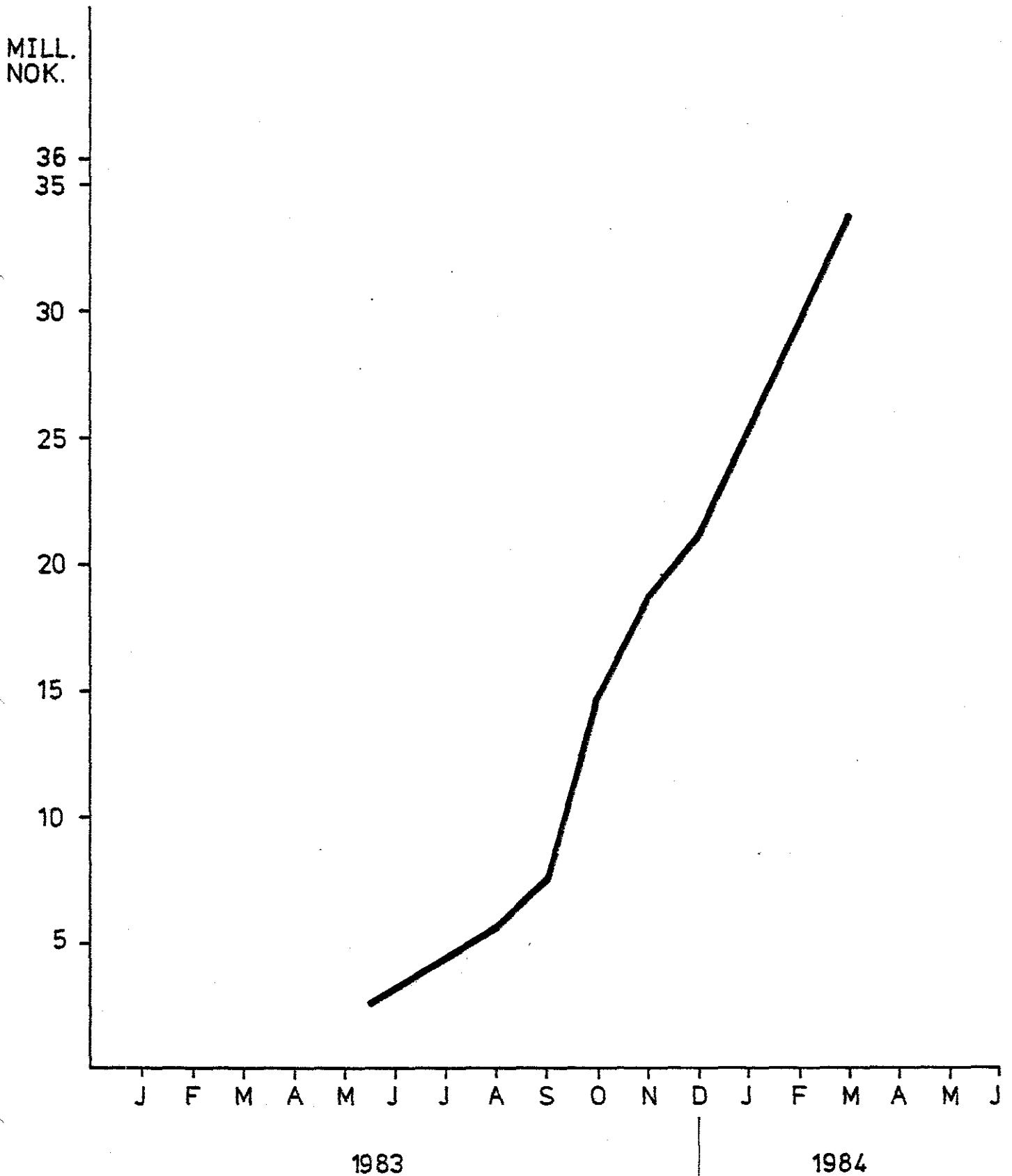
NEF part of Lump Sum	:	562.658	NOK
NEF change orders	:	557.498	NOK
NEF stand by change order	:	93.792	NOK
General assistance, realloated to NEF unit	:	<u>99.512</u>	<u>NOK</u>
		<u>1.313.460</u>	<u>NOK</u>

7.2.5.6 Expenditure Against Time

Expenditure against time for the main contract is shown on the figure 7.4.

EXPENDITURE AGAINST TIME CONTRACT F.142 - HOOK - UP

FIGURE 7.4



7.2.6 Expended Manhours

The Total Expended Manhours are as shown below:

The Manpower Histogram, Overall and by Discipline is shown on figure 7.5.

Management	20.590 hrs
Indirect work	26.750 hrs
Productive work	<u>66.900 hrs</u>
Total	<u>114.240 hrs</u>

+ Split of productive work by discipline:

Structural	9.800 hrs
Piping	27.000 hrs
Instrument	8.900 hrs
Electrical	6.800 hrs
Insulation	<u>-4.400 hrs</u>
Total	<u>66.900 hrs</u>

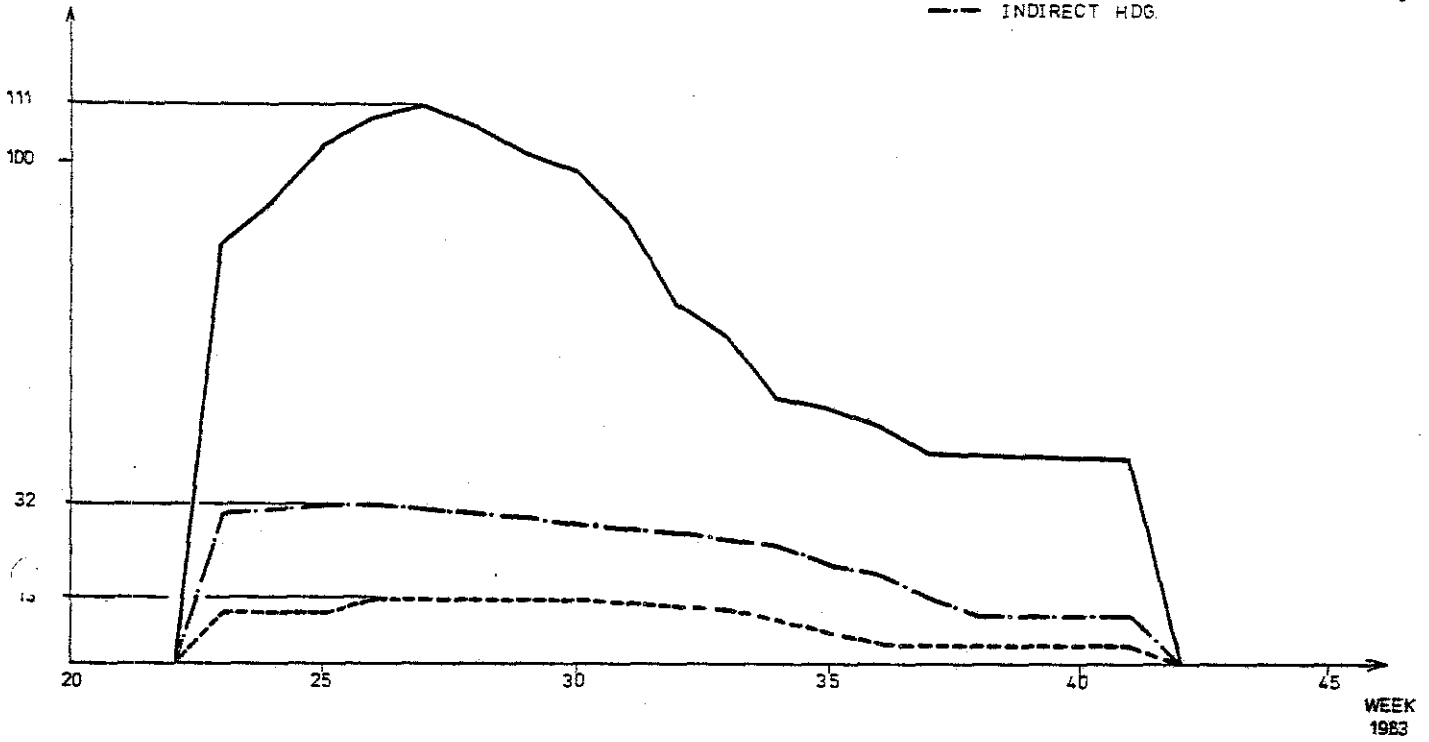
Split of productive work by activity:

Original Scope	: 45.660 hrs
Additional Scope	: 12.140 hrs
Commissioning	: 7.520 hrs
Stand by	: <u>1.580 hrs</u>
Total	<u>66.900 hrs</u>

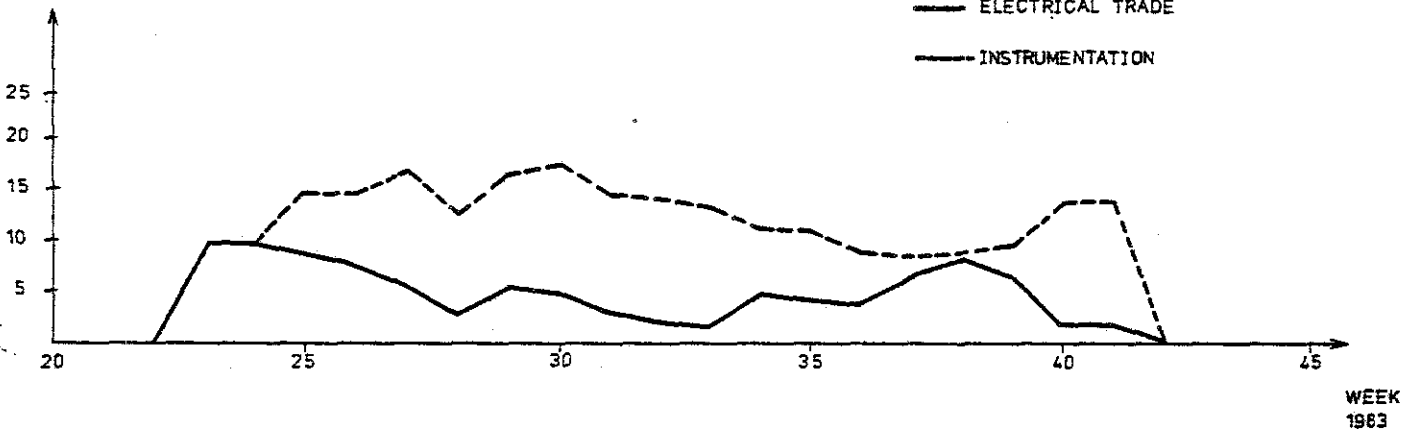
FIGURE 7.5

HOG
NUMBER OF PERSONS
ON BOARD

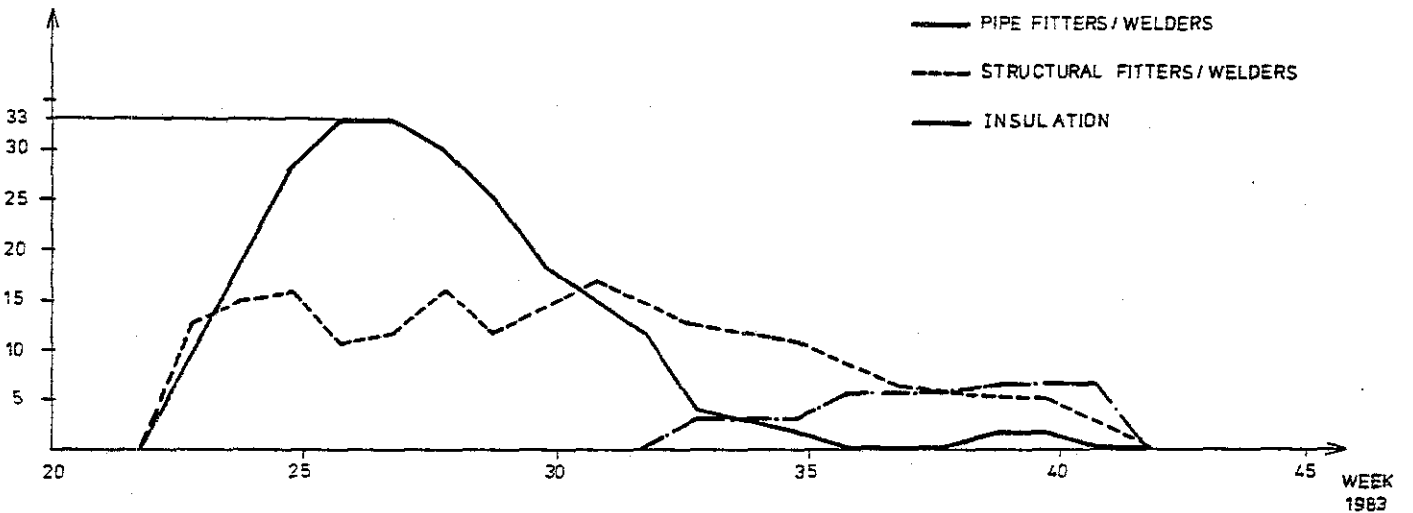
— OVERALL HOG.
- - - MANAGEMENT HOG
- · - · INDIRECT HOG



— ELECTRICAL TRADE
- - - INSTRUMENTATION



— PIPE FITTERS/WELDERS
- - - STRUCTURAL FITTERS/WELDERS
— INSULATION



7.3 OTHER CONTRACTS

Other contracts on this budget line was:

Contract X.022 Schlumberger:	714	KNOK
" F.076 Bloms Oppmåling:	158	KNOK
" F.108 Securitas :	600	KNOK
" F.186 W.O.C. :	160	KNOK
" F.195 Metier :	984	KNOK
" F.198 MOM Offshore :	571	KNOK
" F.211 B.O.C. NowSCO :	1.061	KNOK
" S.954 Terotech :	140	KNOK
Purchase Order - Televerket :	340	KNOK
Misc. Purchase Orders :	873	KNOK

Total cost other contracts : 5.601 KNOK

8 LOGISTICS

8.1 GENERAL

The total cost of the Budget Line Logistics was 54.089 KNOK in current value.

This consist of the flotel cost, marine services, helicopter and Frigg environmental cost.

8.2 FLOTEL COST

The total cost incurred to the TCP-2 Extension Project after reallocation of cost to the other users is 38.317 MNOK. This consists of the following:

Flotel	:	32.913 MNOK
Catering	:	3.141 MNOK
Fuel	:	<u>2.263 MNOK</u>
Total	:	<u>--38:317 MNOK</u>

8.2.1 Bid Evaluation

The detailed Bid Evaluation is given in Appendix 7.

W. Wilhelmsen's Treasure Supporter was selected.

8.2.2 Flotel Cost

The flotel was hired from Wilhelm Wilhelmsen Enterprises Ltd. (WW) for the period 31.05.-21.10.83, totally 144 days.

A daily rate was paid amounting to 370.000,- NOK, of which there was 13.7 % escalation on 70.000,-, total dayrate = 379.219,- NOK.

Catering cost was sub-contracted to Norske Chalk (NC), and paid according mandays plus a handling fee of 5 % to WW for sub-contracting.

The total cost paid for the flotel was 64.061 KNOK inclusive fuel, catering, escalation and additional crew, and this amount was split between the project and Frigg Unit.

8.2.2.1 Project Share

The flotel cost was shared between TCP-2 Extension Project and Frigg Unit - based upon daily personnel onboard (P.O.B.) telexes for the period 31.05.-15.10.83. The last week was allocated on TCP-2 Extension budget. The split was based upon an average of 130 TCP-2 Extension men/day during the whole period, not inclusive WW and NC crews.

The Projects Share of the flotel cost was 32.913 KNOK (not including catering).

8.2.2.2 Other Parties Share

The total amount of 21.171 KNOK was reallocated to Frigg Unit for rental of the flotel. This was total rental cost minus TCP-2 Extension share.

8.2.3 Fuel Cost

Total fuel cost for the flotel amounted to 3.268 KNOK.

Fuel cost was split the same way as the flotel cost; according to mandays.

The projects share of the fuel cost:	2.263 KNOK
Frigg Unit share of the fuel cost :	1.267 KNOK

8.2.4 Catering Cost

Catering cost was paid at a different rate each month, according to mandays.

Total catering cost TCP-2 Extension:	3.141 KNOK
Total catering cost reallocated to Frigg Unit	: 3.568 KNOK

The fuel was split after the same key as hire of the flotel and catering.

8.3 MARINE SERVICES COST

The Marine Services consisted of supply boat, anchor handling tug and stand by boats.

The total cost of these services was 5.448 KNOK.

8.3.1 Supply Boat / Anchor Handling

M/S "NORMAND HUNTER" was chartered from Solstad Rederi A/S on Contract X.038.

Total cost for the anchor handling was:

2 days hire :	61.667,-	NOK
Fuel & lubeoil:	<u>50.640,-</u>	NOK
Total	: <u>112.307,-</u>	NOK

The following supply vessels which already were chartered for use on the Frigg field were reallocated for use on TCP-2 Extension project:

Normand Trader
Normand Conger
Norindo Supplier
Princess Supplier

Total cost per month for the supply vessels was:

Month	Hire	Fuel	Total (NOK)
June	858.810	541.116	1.399.926
July	506.290	238.063	744.353
August	313.066	164.185	477.251
September	222.270	87.597	309.867
October	219.790	124.928	344.718
Total	2.120.226	1.155.889	3.276.115

8.3.2 Stand By Boat

The stand by boat M/V "Standby Master" was chartered from K.S. Stran Service A/S - Contract No. X.083 for the period July - October 1983.

Payments were made according to the following scheme:

Daily charter rate : 15.500 NOK

Daily rate for continous service : 1.500 NOK

July	:	527.000 NOK	
August	:	527.000 NOK	
September	:	510.000 NOK	
October	:	235.284 NOK	(01.10.-14.10.83)
Fuel	:	<u>260.232 NOK</u>	

TOTAL : 2.059.516 NOK = total cost for stand by boat

8.4 HELICOPTER TRANSPORT

Cost for helicopter transport was allocated the project on EAN
Contract No. S.850 - Helicopter Service A/S.

Total cost for each month:

May	:	179.567 NOK
June	:	1.271.100 NOK
July	:	1.125.127 NOK
August	:	793.880 NOK
September	:	669.000 NOK
October	:	<u>247.333 NOK</u>
TOTAL	:	<u>4.286.007 NOK</u>

8.5 TCP-2 EXTENSION ENVIRONMENTATION COST

Environmental cost (catering, helicopter, supply vessel etc.) for each year, outside flotel period:

1981	:	145 days at 3.064	=	444.280 NOK
1982	:	136 days at 3.625	=	493.000 NOK
1983	:	725 days at 2.849	=	<u>2.065.525 NOK</u>
TOTAL ENVIRONMENTAL COST				= <u>3.002.805 NOK</u>

The reason why the rate for environmental cost decreased in 1983, is that total environmental cost for EAN was divided on a considerable larger number of offshore days than the initial budget.

8.6 OTHER CONTRACTS

The total value of other contracts and purchase orders was 3.035 KNOK.

The main other logistics contracts were:

Contract No. F.108 - A/S Norsk Vakt- og Kontrollselvskap Securitas, Safety Officers and Bridge Controllers during the Hook-Up period.

Total cost : 605.000 NOK

Contract No. F208 - Pisces Offshore Ltd., Glasgow, Assistant Rig Officer QP during Hook-Up.

Total cost : 432.000 NOK

Contract No. S.985 - Cecil Cattermoul Ltd., London, rental of video films for showing to personnel on Treasure Supporter.

Total cost : 30.000 NOK

A P P E N D I C E S

V O L U M E III

C O S T

APPENDIX 1

APPENDIX 1

BID EVALUATION
TCP-2 EXTENSION
ENGINEERING SERVICES
CONTRACT F.087

TABLE OF CONTENT:

1. INTRODUCTION
2. EVALUATION OF THE OFFERS
 - 2.1 ECONOMICAL EVALUATION
 - 2.2 TECHNICAL EVALUATION
 - 2.3 CONTRACT EXCEPTIONS
 - 2.4 DISCUSSION
3. RECOMMENDATION

Annex A

Economical Adjustments of the Offers

Annex B

Form A2

Annex C

Form A3

1. INTRODUCTION

A call for bid for the engineering services of the TCP2 Extension Project was issued October 7th 1980 to the following eight companies:

- AKER ENGINEERING A/S
- CJB
- KVAERNER ENGINEERING A/S
- LUMMUS
- NORCONSULT
- NPC
- SOFRESID NORGE A/S
- TECHNIP

The tender documents consisted of a very detailed technical specification of the services to be performed, and a model contract under a lump sum.

An option in the contract calls for assistance on reimbursable basis during construction and commissioning works offshore or onshore.

During the tender period, LUMMUS was allowed to pass their tender document to CREST ENGINEERING LTD, London.

The following four companies replied:

- AKER ENGINEERING A/S (Hereafter called AKER ENG.)
- CREST ENGINEERING LTD (Hereafter called CREST ENG.)
- KVAERNER ENGINEERING A/S (Hereafter called KVAERNER ENG.)
- SOFRESID NORGE A/S (Hereafter called SOFRESID N.)

None of the companies were totally able to perform the engineering services with their own staff.

The following subcontractors were proposed:

- AKER ENG. with WORKFORCE U.K.
- CREST ENG. with LUMMUS France and PETCON A/S Norway
- KVAERNER ENG. with TECHNIP France and KVAERNER LTD U.K.
- SOFRESID N. with SØNNICO Norway and SOFRESID France.

2. EVALUATION OF THE OFFERS

2.1. ECONOMICAL EVALUATION

The original offers were as follows:

- AKER ENG.	41.655	KNOK
- CREST ENG.	47.170	KNOK
- KVAERNER ENG.	48.854	KNOK
- SOFRESID N.	10.643	KNOK

SOFRESID N's offer was based upon performing the services from Oslo, the others from Stavanger which was according to the contract proposal.

Due to inconsistencies in some of the offers and discrepancies between the model contract and the offers, the four companies were invited to come up with a new tender after clarification of the misunderstandings.

The new revised offers were:

- AKER ENG.	31.112	KNOK
- CREST ENG.	47.170	KNOK
- KVAERNER ENG.	36.800	KNOK
- SOFRESID N.	12.250	KNOK

SOFRESID N. increased their offer due to a partly moving of staff from Oslo to Stavanger.

After examination of the offers, CREST ENG. was eliminated due to economical reason.

The three others got a new chance to adjust their offers further by using their personnel in a more flexible way and thus reduce their overheads. SOFRESID N. was requested to give an offer based upon performing their services totally from Stavanger, and to increase their organisation with experienced personnel.

The final bid tabulation is shown in table 1.

Commissioning assistance has been removed from the lump sum. Exceptions to the model contract have been priced as far as possible, and the expected amount of change orders have been added to each offer in order to have comparable figures. These adjustments are given in Annex A.

The final offers (original and adjusted) are:

	Original KNOK	Adjusted KNOK	Average rates NOK/HR
AKER ENG.	29.131	32.991	366
KVAERNER ENG.	31.000	36.660	431
SOFRESID N.	16.542	20.967	295

Table 2 gives the unit rates to be applicable for change orders and assistance during construction and commissioning either offshore or onshore.

In general AKER ENG. has the lowest unit rates, and KVAERNER ENG. has by far the highest.

2.2. TECHNICAL EVALUATION

The different offers have been evaluated with special respect to technical capabilities and estimated manhours to perform the services.

An overall manpower planning is shown as an histogram in Fig. 1.

The Form of Tender did not call for splitting the engineer manhours by discipline, only the draughting work has been split. It is therefore somewhat uncertain to compare directly the breakdown of the manhours estimate in Table 3, because the extent of design and draughting work varies between the three companies.

This point has been clarified during the informal discussion with the remaining three companies.

The overall technical impression of the different companies are:

AKER ENG.

AKER ENG. has put a lot of effort into the bid documents and has prepared a well documented offer with a detailed network planning of the services.

In general the manhours estimates are high, approximately 23% above the E.A.N. estimate.

The overall impression of the technical qualifications of the offered key personnel is very satisfactory.

The services will be performed by 76% local AKER ENG. staff, and the remaining 24% by their sister company, WORKFORCE U.K.

The office location will be their existing office in Stavanger which is well suitable for this project.

KVAERNER ENG.

KVAERNER ENG. has prepared a well documented offer with a detailed network planning of the services.

The menhours estimate is slightly higher than the E.A.N. estimate for the pure engineering work, and somewhat low estimated for the procurement and cost and planning activities.

The overall menhours estimate is 11% above the E.A.N. estimate.

KVAERNER ENG. offers an organisation with experienced, high qualified personnel. 55% of the personnel is KVAERNER OIso staff, 25% KVAERNER LTD U.K., and 30% is TECHNIP France.

KVAERNER ENG. proposes to perform the services from their established office in Stavanger.

SOFRESID N.

The tender documents from SOFRESID N. is less comprehensive than the others.

The planning of the services is very general which makes it hard to discover eventual weak points. However, some bottlenecks have correctly been pointed out.

In general the menhours estimate is low, 13% under the E.A.N. estimate.

The organisation offered by SOFRESID N. consists mainly of lesser experienced Norwegian personnel, and high qualified French personnel as discipline leaders, some of them with experience from FRIGG.

A few weak points in the organisation should be improved (change electrical engineer, add project engineer for technical coordination).

80% of the services will be performed by Norwegian personnel (SOFRESID N./SØNNICO/CONTRACTING), and 20% by SOFRESID France.

SOFRESID N.,s office location will be at NORSEA,s area at Dusavik - STAVANGER, where they will rent barracks for the purpose of this project.

2.3. CONTRACT EXCEPTIONS

The amount of exception from the model contract is extensive from AKER ENG. and KVAERNER ENG., and eventual negotiations might be timeconsuming.

SOFRESID N. has made exceptions to the model contract only for liability and warranty.

2.4. DISCUSSION

AKER ENG,s and KVAERNER ENG,s offers are more detailed and comprehensive than SOFRESID N,s and no important weak points have been discovered.

The technical qualification of the personnel from AKER ENG. and KVAERNER ENG. seems in general to be higher than for SOFRESID N.

This might, however, be of less importance because the project is well defined in the Technical Specifications, and no important changes are foreseen.

All the three companies are therefore technically considered to be capable of performing the required services.

The menhours estimates of SOFRESID N. seem low, particularly bearing in mind that they have no infrastructure in Norway, and have to establish new office facilities in Stavanger. This might be a potential risk of delay to the project.

However, if the progress should be too slow, the model contract allows for E.A.N. to add additional personnel to the engineering company,s organisation at no extra cost. SOFRESID France has in this case guaranteed the necessary back-up.

3. RECOMMENDATION

The price difference between the companies for the lump sum contract (adjusted offer) compared to SOFRESID N. is:

- AKER ENG.	+ 12.024 KNOK
- KVAERNER ENG.	+ 15.693 KNOK

AKER ENG., KVAERNER ENG. and SOFRESID N. are considered to be technically capable of performing the required services in time although AKER ENG. and KVAERNER ENG,s offers are of higher standard than SOFRESID N.

This technical difference can, however, not justify the important difference in price, and it is therefore recommended to award the engineering contract for the TCP-2 Extension Project to SOFRESID N.

TABLE 1

BID TABULATION - ENGINEERING SERVICES

TCP-2 EXTENSION PROJECT

ACTIVITIES	AKER ENGINEERING A/S			KVAERNER ENGINEERING A/S			SOFRESID NORGE A/S			E.A.N.
	HRS	KNOK	NOK/HR	HRS	KNOK	NOK/HR	HRS	KNOK	NOK/HR	HRS
ENGINEERING	61.413	24.046	392	63.190	25.916	410	43.020	14.110	328	44.320
PROCUREMENT	8.600	2.443	284	4.500	2.642	587	6.880	1.250	182	10.240
PLANNING/COST CONTROL	9.600	2.642	275	4.160	2.442	587	6.165	1.182	192	9.600
TOTAL	79.613	<u>29.131</u>	366	71.850	<u>31.000</u>	431	56.065	<u>16.542</u>	295	64.160
CONTRACT EXCEPTIONS		200			1.350		0			
CHANGE ORDERS	10.000	3.600	366	10.000	4.300	431	15.000	4.425	295	
COMPARABLE TOTAL	89.613	<u>32.991</u>		81.850	<u>36.660</u>		71.065	<u>20.967</u>		

TABLE 2

BID TABULATION

UNIT RATES

	AKER	KVAERNER	SOFRESID
SERVICE ON SITE	NOK/DAY	NOK/DAY	NOK/DAY
CONSTRUCTION ENG.	4155	4100	4600
SENIOR SP. ENG.	4410	} 3820	4200
JUN. SP. ENG	3380		3000
CONSTR. SUPERVISOR	4932	3820	4800
TECHNICIAN	2860	3300	2700
WAREHOUSEFOREMAN	2593	3300	2500
SERVICE ON YARD	NOK/DAY	NOK/DAY	NOK/DAY
CONSTRUCTION ENG.	2304	3730	2600
SENIOR SP. ENG.	2448	} 3450	2300
JUN. SP. ENG.	1872		1800
CONSTR. SUPERVISOR	2736	3450	2600
TECHNICIAN	1584	2740	1700
WAREHOUSEMAN	1440	2740	1600
CHANGE ORDERS	NOK/HR	NOK/HR	NOK/HR
PROJ. ENG.	330	525	400
SENIOR SP. ENG.	310	464	365
JUN. SP. ENG.	250	421	275
TECHNICIAN	210	364	250
PURCHASER	285		285
INSPECTOR	200		285
COST ENGINEER	295		285
PLANNING ENG.	275		285
INVOICE CONTROL	200		285

TABLE 3
BREAKDOWN OF THE TIME ESTIMATE

	ESTIMATED MENCHOURS			
	AKER	KVAERNER	SOFRESID	E.A.N.
<u>1. ENGINEERING SERVICES</u>				
1.1 Basic engineering	3950	4000	4875	4000
1.2 Detailed engineering	54803		37445	40320
- Senior specialist engineer		27010	16405	} 14400
- Junior specialist engineers		8280	7150	
- Design office				
. Vessels	3863	700	1450	1920
. Piping	13860	9000	5800	8640
. Structural	9870	4600	395	3840
. Instrumentation	9975	6800	2195	8640
. Electrical	8110	2800	795	2880
- Printing, computer costs etc.				
1.3 Model				
<u>2. PROCUREMENT SERVICES</u>				
- Purchasing	} 8600	2580	3110	5000
- Expediting		1120	} 3770	1200
- Inspection		800		5000
- Forwarding				2500
<u>3. FOLLOW UP OF SERVICES</u>				
- Cost estimate/cost control	4500	} 4160	2820	6700
- Scheduling, reporting	5100		2320	2000

* Engineers included in draughting

ANNEXES

ANNEX A

ECONOMICAL ADJUSTMENTS OF THE OFFERS

1. CHANGE ORDERS

The following adjustments were made:

- An expected amount of 10.000 menhours were added to each tenderer. This is due to expected changes of the flare system, metering system and telecommunication system.
- An additional amount of 5.000 hours were added to SOFRESID due to their low time estimate.

2. CONTRACT EXCEPTIONS

The following adjustments were made:

KVAERNER:

<u>Contract Article</u>	<u>Estimated Cost</u>	<u>Comment</u>
3.4.4.	300 KNOK	30 men at 10.000 NOK
5.3.	50 KNOK	
5.5.1.	1000 KNOK	Taken similar to AKER

AKER:

<u>Contract Article</u>	<u>Estimated Cost</u>	<u>Comment</u>
8.3.8.	200 KNOK	Estimated 500 h at 400 NOK/HR

INFORMATION REGARDING TENDERS. DATA FOR THE BI.

This form and the annexed form A3 should be filled in and submitted to the Ministry of Industry when the operator has reached a conclusion as to which bidder should be chosen and before any recommendations are presented to the partners. When evaluating bids where foreign personnel is included Norwegian labour regulations (with special attention to working hour and wages) must be used for the part planned to take place in Norway or on the Norwegian Continental Shelf.

Identification of tender (see form A1) or description:

Companies submitting bids incl. address (town/country)	Aker Engineering A/S STAVANGER NORWAY	Kvaerner Engineering A/S OSLO NORWAY	Sofresid Norge A/S OSLO NORWAY			
Contract sum (adjusted to be comparable)	NOK 32.991.000	NOK 36.660.000	NOK 20.967.000			
Norwegian part %	76%	55%	80%			
Is the bid based on lump sum or rates?	Lump sum	Lump sum	Lump sum			

INFORMATION REGARDING TENDERS. DATA FOR BIDS

This form should be filled in and submitted to the Ministry of Petroleum and Energy when the operator has reached a conclusion as to which bidder should be chosen and before any recommendations are presented to the partners. When evaluating bids where foreign personnel is included, Norwegian labour regulations (with special attention to working hour and wages) must be used for the part planned to take place in Norway or on the Norwegian Continental Shelf.

Identification of tender (see form A1) or description:

Companies submitting bids incl. address (town/country)	Aker Engineering A/S Stavanger - N	Kvaerner Engineering A/S OSLO - N	Sofresid Norge A/S OSLO - N			
Total No. of man-hours:	89.613	81.850	71.065			
a) By Norwegians:	68.105	45.017	56.852			
b) By foreign personnel in Norway (incl. shelf):	21.508	36.833	14.213			
Peak No. of men:	54	46	32			
Place of execution of work:	Stavanger	Stavanger	Stavanger			
Scheduled date of delivery or completion:	1/8-1982	1/8-1982	1/8-1982			

Recommended contractor:

SOFRESID

Short explanation of major differences between the technically competent and lowest price.

APPENDIX 2

APPENDIX 2

TCP-2 EXTENSION

BID EVALUATION

CONSTRUCTION CONTRACT

TABLE OF CONTENT:

1. TECHNICAL COMPARISON
2. COMMERCIAL COMPARISON
3. DISCUSSION
4. RECOMMENDATION

1. TECHNICAL COMPARISON

The following is a clarification of the technical proposals given by the four yards selected for the final discussions.

The yards in question are:

Hollandse Constructie Groep (HCG)	Holland
Ponticelli Freres	France
Stord Verft A/S	Norway
Vigor A/S	Norway

The clarification is presented yard by yard.

1.1.0 HCG

This yard plans to perform the prefabrication at the site in Leiden, Holland, and the erection partly indoor in Schiedam. Distance between the two facilities is about 30 km. Project Control is first established in Leiden, then moves to Schiedam.

1.1.1 Technical Competance

Both yards are experienced in production of offshore modules, and HCG has delivered several modules for the North Sea exploration. The yard has no experience in working with EAN or SNEA(P).

The yards have sufficient number of skilled welders, fitters erectors and supervisors.

The available equipment is of acceptable standard and quantity.

The facilities at the Leiden yard are not new but of an acceptable standards.

One of the two facilities at the Schiedam yard is mostly new, and have high standard. The other site is old and rented by HCG, and of rather low standard.

The quality assurance for the yards is acceptable, and the lay-out of the quality control procedures are well defined.

1.1.2 Technical Proposal

The modules will be structurally erected at the site in Schiedam while the piping prefabrication will be performed in Leiden. All steel work are normally completed indoor. The modules will be loaded-out from the Schiedam yard by means of hydraulic trucks and not by skidding.

The manpower projection for the different disciplines is presented in Appendix I.

Remark: HCG estimates a piping manpower projection which is 60 percent of average.

HCG intend to subcontract Electrical & Instrument installation, Load-out and Fire & Gas detection installation. The subcontractors are deemed to be of acceptable standard.

The quality control procedures for the present work have been checked and found to be in order.

1.1.3 Work Load

The present workload is as follows:

7 preassemblies	load out May - 82
1 living quarter	load out May - 82
4 decks	load out Febr./March - 82
4 modules	load out Oct. - 82

The workload on prefabrication drops dramatically February and March 1982 which is the expected start of prefabrication for TCP-2 Extension modules. The assembly work is scheduled to start in August which is two months prior to load-out of 4 modules.

It is reported that the on-going work is suffering for some delays compared to the initial planning and to the corrective planning.

This delays seem to be due to bad performances of Leiden prefabrication shop. Corrective actions have been undertaken by HCG by subcontracting more outside, but HCG Management seems to be understaffed to ensure an efficient coordination.

Based upon the fact that HCG requires 59 weeks of fabrication period from the date of contract signature, the tow out of the modules is estimated to take place mid April 1983 which is two weeks after the scheduled tow-out date.

1.1.4 Conclusion

As HCG has two different yards in Schiedam, the one which is HCG's property should be required due to higher standard.

Based upon the above mentioned argument we judge HCG to be able to perform the job to an acceptable standard and two weeks behind original EAN schedule, but we make strong restriction on HCG's ability to respect their planned completion date.

1.2.0 Ponticelli Freres

Ponticelli usually prefabricates steel work at Ambes and erect/load out the assemblies at Bassens.

On this project Ponticelli would prefabricate all pipework at its shop in Port Jerome near Le Havre and would subcontract about 15% of the structural prefabrication to local shops near Bordeaux.

Project control is first established in Ambes, then moves to Bassens (distance about 20 km in Bordeaux suburb.)

1.2.1 Technical Competence

Ponticelli is experienced in production of offshore modules and has performed similar work for the North Sea exploration. Ponticelli has experience in working with EAN and SNEA(P).

Port Jerome Ponticelli has no experience in fabrication of offshore equipment but has been working for similar equipment for land based refinery plants and for nuclear power station prefabrication work.

The yards in question have sufficient number of qualified welders, fitters erectors and skilled supervisors.

The number of fabrication equipment (welding machines, cutting facilities etc...) is low compared to the three other bidders, but still on an acceptable level.

The prefabrication facilities at Ambes and Port Jerome are of good standard, the latter is exclusively dedicated to pipework.

The erection facility at Bassens is outdoor, facing a drydock used for load-out of assemblies.

The quality control procedures at Port Jerome will be same standard than at Ambes. These Q.C.P. were found satisfactory especially in material traceability and NDT reporting.

The Quality Assurance Manual is still unfinished and should be improved.

The quality control procedures will have to be followed closely by the supervision team especially at the Port Jerome site due to lack of experience with offshore related works.

1.2.2 Technical Proposal

Prefabrication of the piping will be performed at Port Jerome Ponticelli close to Le Havre, about 15 percent of the structural prefabrication will be subcontracted. The modules will be assembled and erected at the dockside on the yard in Bassens.

The modules will be skidded onto the barge.

The manpower projection is shown in Appendix I.

Remarks: The Ponticelli estimation of structural manpower is 45 percent higher than the average.

The number of estimated manhours for management and service is rather low for Ponticelli compared to Norwegian yards.

Service: 10 percent of direct manhours

Management: 13 percent of direct manhours.

1.2.3 Work Load

The present work load is as follows:

5 modules : load out March-Nov. - 82
4 modules : load out Febr. - 82
1 module : load out Nov. - 82

The work load required for the piping prefabrication is well below the maximum capacity at Port Jerome Ponticelli.

The assembly at the Bassens site will be performed at a time of low activity. (The work load reduces from maximum capacity to low capacity two months prior to start of erection of the TCP-2 Extension modules).

Ponticelli has a very important commitment for the construction of MCP Compression Module and we know that TOTAL will continue to keep a high level of pressure on Ponticelli to obtain a load-out on schedule, which in fact coincide with the start of erection of TCP-2 Extension Modules.

Based upon the figures given by Ponticelli there is no reason to foresee problems in having the modules completed on time, i.e. tow out 01.04.82.

1.2.4 Conclusion

Due to some weakness in the quality assurance/quality control procedures, a greater effort from the supervision team is required compared to the other tenders.

Technically there is not doubt that Ponticelli is able to perform the job to a high standard and on time.

1.3.0 Stord Verft A/S

The yard will perform the work as an entity at Stort Verft A/S.

1.3.1 Technical Competance

Stord Verft A/S has experience in building offshore structures and modules, the yard has little experience in working for EAN and SNEA(P).

A numerous staff of qualified welders, fitters, erectors and supervisors is available, and the equipment is modern and of high standard.

The facilities are large and modern and of high standard.

The quality assurance is well defined in a manual and the quality control procedures are judged to be in order. The NDT follow up is computerized for the structural and piping discipline. The material traceability, as per previous project report, could be questionable thus requiring special attention in the course of the project.

1.3.2 Technical Proposal

Stord Verft A/S plans to prefabricate the structure of Module 50 piecewise and erect out-door at the dock side.

The load out will be performed by skidding.

The manpower projection is shown in Appendix I.

Remarks: The estimate of Stord Verft A/S for the manpower needed for the mechanical discipline is 40 percent of the average estimate.

The service manhour estimate is about 19 percent of the direct manhours.

The management manhour estimate is about 33 percent of the direct manhours.

These estimates are high compared to foreign yards.

It may indicate a better quality control and project management than for the foreign yards.

Stord Verft A/S intends to subcontract the insulation work, the painting and sandblasting, and electrical and instrument installation.

The quality control procedures have been checked and found to be in order.

1.3.3 Work Load

The present work load is a jack-up rig which has scheduled delivery in April 1982.

Due to low activity Stord Verft A/S has dismissed part of their work force.

Based upon this fact there should be no doubt that Stord Verft A/S can finish the job on time.

1.3.4 Conclusion

Based upon the above mentioned items it is judged that Stord Verft A/S is able to perform the job to the correct standard on time.

1.4.0 Vigor A/S

This yard will perform the whole job at one site.

1.4.1 Technical Competance

Vigor A/S has experience in construction offshore modules, and has been working with EAN contrac for Frigg treatment and compression modules.

The yard has sufficient number of skilled welders, fitters, erectors and supervisors available for this job.

The equipment is modern and of high standard and sufficient quantity.

The facilities are fairly new and modern.

Vigor A/S has submitted a lay-out of their quality assurance and quality control which are acceptable.

Climatic conditions have on previous projects hampered the progress of the work and necessitated expensive sheltering and heating equipment.

The yard is below standard for what it concerns cleanness of pipework.

1.4.2 Technical Proposal

The modules will be erected out door along the quay-side and the module will be skidded on board the barge, while the pancake will be lifted on board.

The barge should be available at the yard in Jan./Febr. 1983.

The manpower projection for the different disciplines is shown in Appendix I.

Remarks: The manhour estimate for the electrical discipline is about 55 percent of the average manhour estimate.

The grand total manhour estimate is about 25 percent higher than the average.

The service manhour estimate is 27 percent of the total direct manhours.

The management manhour estimate is 30 percent of the total direct manhours.

The last two figures are high compared to foreign yards, and normal compared to Norwegian yards.

It may indicate a better quality control and a higher activity level for the "overhead" functions compared to foreign yards.

Vigor A/S plans to subcontract some of the structural steelwork, the galvanizing and insulation and electrical/instrument installation.

There is nothing outstanding concerning the quality assurance/control procedures.

1.4.3 Work Load

The present work load consists of fabrication of jackets and decks for offshore installation, scheduled delivery prior to start fabrication TCP-2 Extension modules.

There is no reason to believe that problem related to the reported work load will obstruct Vigor A/S from delivering the modules on time.

1.4.4 Conclusion

Based upon the above it is believed that Vigor A/S is able to construct the modules to an acceptable standard on time.

2. COMMERCIAL COMPARISON

Based upon the revised technical documents, the four short listed companies Vigor, Stord Verft, HCG and Ponticelli have revised their lump sum prices accordingly.

In order to evaluate the expected final difference in cost between the four companies, an amount of changes/additional work has been predicted, and adjustment have been made concerning transportation of the modules from the yard to Frigg and additional cost incurred to the yard supervision team.

2.1. Lump Sum

The lump sum prices are as follows:

Stord Verft A/S	36.764.000	NOK
Vigor A/S	45.283.000	NOK
HCG	32.600.000	NOK (exchange rate 2.34)
Ponticelli	31.500.000	NOK (exchange rate 1.0)

2.2. Additional Work/Changes

Additional work and changes in work will be remunerated according to the unit prices given in the offers.

The unit prices have been evaluated by pricing specific works as shown in Appendix II. Only structural and piping disciplines which are the most important have been evaluated.

For a specific work representing an average of the modules, the price ratios are as follows:

Stord Verft A/S	3.4
Vigor A/S	1.9
HCG	2.5
Ponticelli	1.0

These factors have been used in order to establish the additional costs depending upon the changes in the work (Appendix III).

2.2.1. Changes

The technical specifications forming the basis the basis of the offers are relatively detailed worked out.

The expected amount of changes is therefore relatively low.

Areas known today which might be subject to changes are:

- relief system
- metering system
- deluge system
- seafastening

In addition by experience we anticipate changes due to possible errors in technical documents, non conformities of material etc.

The estimated amount of changes is 5%. This is a very low level compared to other projects. This represents (Appendix III):

Stord Verft A/S	5.300 KNOK
Vigor A/S	2.900 KNOK
HCG	3.900 KNOK
Ponticelli	1.600 KNOK

2.2.2. Additional Work

The only major additional work known by today to be performed by the contractor is:

- Transportation frame and storage floor for TCP-2

Other additional work is difficult to predict by today, but by experience a low estimate is 10%. (Appendix III).

- Stord Verft A/S	10.600 KNOK
- Vigor A/S	5.800 KNOK
- HCG	7.800 KNOK
- Ponticelli	3.200 KNOK

2.3. Transportation

The fuel and tugs rental cost for the transport from the yard to Frigg is estimated as follows:

- Stord Verft A/S	40 KNOK
- Vigor A/S	100 KNOK
- HCG	180 KNOK
- Ponticelli	300 KNOK

2.4. Supervision

The difference in yard supervision cost between the different yards compared to Stord Verft A/S is estimated as follows:

- Stord Verft A/S	- KNOK
- Vigor A/S	300 KNOK
- HCG	400 KNOK
- Ponticelli	1000 KNOK

2.5. Final Expected Costs

A summary of the costs is given in the tabulation below.

All costs are given in KNOK.

	Lump Sum	% Diff.	Changes	Additions	Transport	Super- vision	Total	% Diff.
STORD VERFT	36.764	16.7	5.300	10.600	40	-	52.700	40.0
VIGOR A/S	45.283	43.7	2.900	5.800	100	300	54.383	44.6
HCG	32.600	3.5	3.900	7.800	180	400	44.880	19.4
PONTICELLI	31.500	0	1.600	3.200	300	1000	37.600	0

3. DISCUSSION

The four tenders are technically equivalent with regards to work performance.

- Ponticelli, Stord Verft and Vigor are deemed capable to respect the planned completion date.
- HCG planned completion date is questionable and there are reports from Statoil on problems and delays with the delivery of the Statfjord C modules at HCG.
- Ponticelli, Stord Verft and Vigor are deemed to be able to cope with extra works if any, due to their low work load during the erection phase of TCP-2 Extension Modules.
- A total of 15% changes and additional works, although very low compared to previous North Sea projects seem realistic with regards to the status of engineering studies.
- The estimation of changes and additional works leads to great differences in the final expected cost in the favour of Ponticelli. Furthermore the estimated amount of changes are very low compared to other projects.

4. RECOMMENDATION

Based upon the lowest price, both the lump sum and the expected final price, it is recommended to award the construction contract of the TCP-2 Extension modules to PONTICELLI.

AVERAGE MANHOUR	FEATURE	HCG*	PONTICELLI	STORD**	VIGOR**
44.200	Structural	15% high. than av.	45% high. than av.	90% of av.	10% high. than av.
2.800	Mechanical	30% of aver.	70% of av.	40% of av.	15% high. than av.
62.000	Piping	60% of av.	90% of av.	80% of av.	5% high. than av.
5.500	Electrical	30% high. than av.	25% high. than av.	10% high. than av.	55% of av.
16.500	Instrument	10% high. than av.	Average	10% high. than av.	85% of av.
13.000	L.O + Sea Fastening	20% high. than av.	10% high. than av.	80% of av.	95% of av.
185.000	GRAND TOTAL ***	80% of av.	5% high. than av.	5% high. than av.	25% high. than av.

APPENDIX I MANPOWER PROJECTION COMPARED TO AVERAGE OF 9 TENDERS

* Service is included in these manhours

** Foremen manhours is not included.

*** Grand Total Includes Manpower for Service and Management

APPENDIX II

UNIT PRICES FOR ADDITIONAL WORK

	VIGOR	STORD	HCG	PONTICELLI		
A	Extra work related to piping for new CV 205	316.864	738.500	192.429	141.917	Piping weight 7.20 Tons
B	Extra work related to new str. PC 20x5m	610.710	1.472.550	2.100.696	535.595	Struc. weight 30 Tons
C	A+B: Alt. I	927.574	2.211.050	2.293.125	677.512	
D	Extra work related to add. PC 16x4m	367.360	899.068	1.388.269	330.268	Weight 15 Tons
E	Extra work related to 2x8" deck drain ISO's	84.830	180.192	60.776	38.988	ISO 2528 EA 8" DR Weight 2.30 Tons
F	D+E	452.190	1.079.260	1.449.046	369.255	
G	A+E	401.694	918.692	253.205	180.905	Piping only.
H	B+D	978.070	2.371.618	3.488.695	865.863	Structural only.
I	C+F: Alt. II	1.379.764	3.290.310	3.742.171	1.046.767	Struc.+Piping sum
J	Extra work related to one 1 1/2" SS line + one 2" SS line	62.502	114.254	32.347	16.261	ISO 2025 & 2026 EAT & EZS Weight 0.32 Tons
K	J+G = J+A+E	464.196	1.032.946	285.552	197.166	Piping only Weight 9.8 Tons
	Factors based upon "A"	2.2	5.2	1.4	1.0	Changes for piping Weight 7.20 Tons
	Factors based upon "E"	2.2	4.6	1.6	1.0	Changes for piping Weight 2.30 Tons
	Factors based upon "J"	3.8	7.0	2.0	1.0	Changes for piping Weight 0.32 Tons
	Factors based upon "K"	2.4	5.2	1.4	1.0	Changes for piping Weight 9.82 Tons
	Factors based upon "B"	1.1	2.7	3.9	1.0	Changes for struct. Weight 30 Tons
	Factors based upon "D"	1.1	2.7	4.2	1.0	Changes for struct. Weight 16 Tons
	Factors used for compr.	1.9	4.2*	2.5	1.0	

*Corrected to 3.4 after a 20% reduction by Stord

Total steel weight PC+M50 Ws = 40+230 = 270 Tons
 Total piping weight Wp = 283+27+59+70 = 440 Tons
 Average mhrs offered by tenders Pip.: 61.800/Str. 44.200 mhrs.

COST OF ADDITIONAL WORK / CHANGES
AS A FUNCTION OF % CHANGES/ADDITIONS (REF PONTICELLI)

COST IN
MILLIONS DOLLARS

A

12
11
10
9
8
7
6
5
4
3
2
1

STORD VERET

HCG

VIGOR

PONTICELLI

5

10

15

%

CHANGES / ADDITIONAL
WORK COMPARED TO
ORIGINAL BUDGET
FOR PONTICELLI

APPENDIX III

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APPENDIX 3

APPENDIX 3

LIFTING BID EVALUATION

CONTENT:

1. SUMMARY
2. BID EVALUATION
3. CONCLUSION

LIFTING BID EVALUATION

1 SUMMARY

Offers for the Lifting and Transportation (as an option) for the TCP-2 Extension modules were received from:

- K/S Heerema Seaway A/S (HS)
- Mcdermott International Inc. (MCD)

MCD could not guarantee availability of the vessel in the requested period, and the offer did not included for weather stand by.

HS was awarded the contract because of the best commercial offer.

2 BID EVALUATION

The following criteria are compared in the hereafter tabulation:

1. Completeness of the bids
2. Lifting barge proposed
3. Availability
4. Price comparison
5. Unit Rates comparison
6. Major exception which lead to price adjustment

1. COMPLETENESS
OF THE BIDS

K/S HEEREMA SEAWAY A/S

Missing:

- exceptions to Model Contract (but being negotiated with Heimdal)
- lifting chart on CDPI.
- detailed programme of the work before lifting.

2. LIFTING
BARGE
PROPOSED

First alternative: (most probable)

Crane vessel ODIN - capacity 3000 T
Panamean flag - able to perform
the lifts from TCP-2 south side.
Helideck to be approved by Authorities/
Helicopter Services.

Second alternative: (at Heerema's option)

SSCV BALDER or HERMOD
Capacity 3000 T + 2000 T
Panamean flag - able to perform the lifts
from TCP-2 East site - able to connect a
personnel gangway to TCP-2.

McDERMOTT INTERNATIONAL, INC.

Missing:

- all prices related to cargo barge and transportation (propose at cost + fee 5%)
- detailed task prices.

DP 101 (Ex- NARVAL)

SSCV of 2000 T capacity - able to perform
the lifts from TCP-2 south side.

3. AVAILABILITY

K/S HEEREMA SEAWAY A/S

McDERMOTT INTERNATIONAL, INC.

Crane barge so far available during the anticipated lifting period (10th May - 30th May 1983)

HS is prepared to inform EAN in advance before entering into a contract with other clients in the period mentioned (equal "first refusal").

Following notification schedule was negotiated and agreed with Heerema:

by: 01.02.83: 10-day period within the period 10-30th May given by EAN

by: 01.04.83: 7-day period within the above 10-day period given by EAN.

MCD is unable to confirm the availability of derrick barge during the period requested.

(Reference to Tender

+ Telex BX - 03 - 2099 of March 29
+ Telex BRU - 04 - 1091 of April 19

4. PRICE COMPARISON

K/S HEEREMA SEAWAY A/S

McDERMOTT INTERNATIONAL, INC.

		DFL	KNOK	:		\$	KNOK
				:	<u>TASK COMPARISON</u>		
Task 1	(Transportation eng.)	130.000	300	:			
Task 2	(Cargo barge)	1.210.000	2.800	:			
Task 3	(Transportation)	1.085.000	2.500	:	Except 2 and 3 not quoted	2.800.800	16.750
Task 4	(Lifting eng.TCP 2)	260.000	600	:			
Task 5	(Cleaning + prep.TCP 2)	1.750.000	4.030	:	1.4.5.6		
		+ 890.000	2.050	:			
Task 6	(Lifting TCP 2)	2.625.000	5.590	:			
		+ 1.750.000	4.030	:			
Task 7	(Eng.lifting CDP1)	80.000	180	:			
Task 8	(Lifting CDP1)	1.340.000	3.090	:		723.000	4.320
		+ 1.800.000s	4.150	:			

COMBINED COMPARISON

1+4+5+6	Eng. + platform prep. + lifting + mob/demob TCP 2	7.205.000	16.600	:	Eng. + platform prep. + lifting + mob/demob/TCP 2	2.800.800	16.750
2 + 3	Transp./TCP 2	2.295.000	5.300	:	Transp. TCP 2	NA	-
7 + 8	CDP1 (combined with TCP 2)	3.220.000	7.420	:	CDP1	723.000	4.320
	Mob/demob included represents:	3.500.000	8.200	:	By deduction, mob/demob. should represents:	774.200	4.620

5. UNIT RATES
COMPARISON

K/S HEEREMA SEAWAY A/S

Lifting vessel stand by

SSW 675.000 DFL
ODIN 450.000
Cargobarge 6.000
Tug 0000HP 22.500

at work

SSCV 225.000 DFI
ODIN 550.000

Engineering manager/home office 210 DFI
Senior draughtsman 130 DFI
Foreman (on fabricates /and) 200 DFI

McDERMOTT INTERNATIONAL, INC.

Lifting vessel stand by

DB 101 187.625 \$

NA
NA

- 61 \$
- 34 \$
- 46 \$

6. MAJOR EXCEPTIONS
WHICH LEAD TO
PRICE ADJUSTMENTS

K/S HEEREMA SEAWAY A/S

McDERMOTT INTERNATIONAL, INC.

Weather down time

Included

Excluded

Adjustment of 2 days derrick barge
187.625 x 2 = 375.250 \$

Work permit procedure

Acknowledge

Stringment

"Hot working permits will be issued in a
timely manner as not to delay the preparation
and installation works".

"Contractor's prices are based on Company
supplying all necessary permits to perform the
Work. Any delays caused in obtaining the
necessary permit for performing the work 24 hours
per day.... will be for Company's account at stand
by rates".

Contractors plans to mobilize a team of
personnel to perform platform preparations
without support of crane vessel, so that no
stand by of equipment might be changed.

Access: Already discussed "in a timely manner":
if personnel gangway is not available.

Required

3 BID EVALUATION - LIFTING ON TCP-2 EXTENSION

A. Prices

The non adjusted lump sum prices are:

	MCD	HS
Lifting	16.744 KNOK	16.600 KNOK
Transportation	No proposal	5.300 KNOK

B. Evaluation

B.1 McDermott International Inc.

- Can not guarantee availability of barge in the required period between 10-30 May 1983.
- Offer does not include for weather stand by, daily rate: 1.100 KNOK.
- No commitment for transportation.
Proposal: at cost plus 5 %.

B.2 K/S Heerema Seaway A/S

- Guarantee availability of barge, ODIN in the requested period.
- Offer include weather stand by.
- Break down of cargo barge rental and transportation as follows: (Mob. and demob. included).

Cargo barge rental 133 D x DFL	6.000	=	1.804 KNOK
Towing tug 37 D x DFL	22.500	=	1.919 KNOK
Fuel and lubs		=	1.461 KNOK
On/Offshore survey		=	80 KNOK
	TOTAL	=	5.300 KNOK

- The cargo barge rental/transportation offer is given as an option, valid to May 25, 1982.

C. Recommendation

Based upon the above we recommend to award the contract for the Lifting to K/S Heerema Seaway A/S, and keep the transportation as an option.

APPENDIX 4

APPENDIX 4

HOOK UP AND PLANNING

CONTENT:

LEVEL II PLANNING

LEVEL III PLANNING (One Example)

PRODUCED BY HAUGESUND - DE GROOT

SCHEDULE : LEVEL 2

SORTED BY PLANNED START

ID:50 PROJECT: TCP2

REPORT NUMBER : BARL2

DATASET : LEVEL2

LOCA SYS TION TEN	DESCRIPTION	% COM	1 JUN 83	8 JUN 83	15 JUN 83	22 JUN 83	29 JUN 83	6 JUL 83	13 JUL 83	20 JUL 83	27 JUL 83	3 AUG 83	10 AUG 83	17 AUG 83	24 AUG 83	31 AUG 83	7 SEP 83	14 SEP 83	21 SEP 83	28 SEP 83	REMARKS
9P2 (DRILLING PLATFORM NO.2)																					
83 01	AIR SYSTEM	100	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
83 53	CONTROL ROOM EQUIPMENT	100	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
83 54	METHANOLATED WATER DISPOSAL	100	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
85																					
85 12	ODIN GAS TREATMENT LINE	0	I	I	I	I	I	I	I	I	I	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	I	I	I	I	I	I	I	I	I "SYSTEM ACCEPTED" PC2=100
85 14	ODIN GAS SUPPLY LINE	0	I	I	I	I	I	I	I	I	I	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	I	I	I	I	I	I	I	I	I "SYSTEM ACCEPTED" PC2=100
TCP2 (COMPRESSION)																					
87 20	POWER GENERATION 5.5 KV	100	I	I	I	I	I	I	I	I	I	CCCCCCCCCCCCCCCCCCCC	I	I	I	I	I	I	I	I	I
87 28	EMERGENCY SHUTDOWN(HYDRAULIC &	100	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
TCP2 EXTENSION																					
88 01A	INSTRUMENT AIR DISTRIBUTION	100	I	I	I	I	I	I	I	I	I	CCI	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
88 01B	SERVICE AIR DISTRIBUTION	100	I	I	I	I	I	I	I	I	I	CCI	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
88 02	FUEL GAS	100	I	I	I	I	I	I	I	I	I	CCC	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
88 03A	CABLE TRAYS	100	I	I	I	I	I	I	I	I	I	CC	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
88 03B	300V POWER DISTRIBUTION	100	I	I	I	I	I	I	I	I	I	CCCCC	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
88 03C	NORMAL LIGHTING	100	I	I	I	I	I	I	I	I	I	ICC	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
88 03D	EMERGENCY LIGHTING	100	I	I	I	I	I	I	I	I	I	ICE	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
88 03E	EMERGENCY POWER (220V NO BREAK)	100	I	I	I	I	I	I	I	I	I	CCCC	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED

LEVEL 2 BARCHART

ELF AQUITAINE MORGE A/S FRIGG TCP2 EXTENTION
 PRODUCED BY HAUGESUND - DE GROOT
 ID:50 PROJECT: TCP2

PAGE : 2
 SCHEDULE : LEVEL 2
 REPORT NUMBER : BARL2

RUN DATE 12-SEP-83
 SORTED BY PLANNED START
 DATASET : LEVEL2

LOCA	SYS	TIOM	TEH	DESCRIPTION	%	JUN 83	JUN 83	JUN 83	JUN 83	JUN 83	JUL 83	JUL 83	JUL 83	JUL 83	AUG 83	AUG 83	AUG 83	AUG 83	SEP 83	SEP 83	SEP 83	SEP 83	REMARKS	
BB	03F			24V DC	100	I	I	#####															I SYSTEM ACCEPTED	
BB	03G			GROUNDING	100	I	I	I	I	I	I	#####												I SYSTEM ACCEPTED
BB	03H			TRACE HEATING	100	I	I	#####																I SYSTEM ACCEPTED
BB	03J			GENERAL (NO CONN. INVOLVED)	100	I	I	#####																I SYSTEM ACCEPTED
BB	04A			HIGH PRESSURE RELIEF TO CV 24	100	#####																		I SYSTEM ACCEPTED
BB	04B			LOW TEMPERATURE RELIEF	99	I	I	I	I	I	#####													I SYSTEM ACCEPTED
BB	05			LOW PRESSURE RELIEF	100	I	I	I	I	I	I	I	I	#####										I SYSTEM ACCEPTED
BB	06A			PUBLIC ADDRESS AND PUBLIC ALARM	100	#####																		I SYSTEM ACCEPTED
BB	06B			GAS DETECTION	100	#####																		I SYSTEM ACCEPTED
BB	06C			FIRE DETECTION	100	#####																		I SYSTEM ACCEPTED
BB	09			HYDRAULIC & SHUTDOWN SYSTEMS	95	I	#####																	I SYSTEM ACCEPTED
BB	09A			HIGH PRESSURE METHANOL	100	I	I	#####																I SYSTEM ACCEPTED
BB	09B			METHANOL INJECTION TO NEF	100	I	I	I	#####															I SYSTEM ACCEPTED
BB	10A			OPEN DRAINAGE	100	I	I	I	#####															I SYSTEM ACCEPTED
BB	10B			CLOSED DRAINAGE	100	#####																		I SYSTEM ACCEPTED
BB	10C			METHANOLATED WATER	100	I	I	#####																I SYSTEM ACCEPTED
BB	11			CONDENSATE	99	#####																		I SYSTEM ACCEPTED
BB	12A			NEF TREATMENT LINE	98	I	I	I	I	I	#####													I SYSTEM ACCEPTED
BB	12B			ODIN GAS TREATMENT LINE	98	I	#####																	I SYSTEM ACCEPTED
BB	14A			NORTH EAST FRIGG GAS SUPPLY LI	98	I	I	I	I	#####														I SYSTEM ACCEPTED
BB	14B			ODIN GAS SUPPLY LINE	99	I	I	I	#####															I SYSTEM ACCEPTED
BB	16			GLYCOL HEATING MEDIUM	100	#####																		I SYSTEM ACCEPTED
BB	17A			FIRE WATER	100	#####																		I SYSTEM ACCEPTED

LEVEL 2 BARCHART

KEY: T-TIMEOUT #-PROGRESS X-DURATION .-FLOAT C-COMMISSIONING

PRODUCED BY HADGESUND - DE GROOT

SCHEDULE : LEVEL 2

SORTED BY PLANNED START

ID:50 PROJECT: TCP2

REPORT NUMBER : BNL2

DATASET : LEVEL2

LOCA	SYG	DESCRIPTION	Z	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	REMARKS	
TION	TEM		CUM	JUN 83	JUN 83	JUN 83	JUN 83	JUN 83	JUL 83	JUL 83	JUL 83	JUL 83	AUG 83	AUG 83	AUG 83	AUG 83	SEP 83	SEP 83	SEP 83	SEP 83			
BB 170		DELUGE WATER	58	I	I	I	I	I	I	I	I	I	XXXXXXXXXXXX				CCCCCT		I	I	I	I	
BB 17C		EXTINGUISHING SYSTEM	100										CC	I	I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
BB 18		WASHDOWN	100	I									CC		I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
BB 22		MISCELLANEOUS	97	I																			
BB 25A		STRUCTURE	97	I																			
BB 25B		ACCESS & ESCAPE WAYS	97																				
BB 33		UTILITY WATER	100	I	I								CI		I	I	I	I	I	I	I	I	I SYSTEM ACCEPTED
OP (QUARTERS PLATFORM)																							
96 11		TELECOMMUNICATIONS, TELEMETRY	100	I													CCCCCCCCCCCC	I	I	I	I	I	
96 14		CONTROL ROOM	91	I	I	I																	
96 17		ELECTRICAL	100	I	I																		I SYSTEM ACCEPTED

LEVEL 2 BARCHART

KEY: T=TIMENOW @=PROGRESS X=DURATION .=FLOAT C=COMMISSIONING

END OF REPORT

TASK	DESCRIPTION	D PHYS I AREA S	EARLY START	EARLY FINISH	1 JUN 83	8 JUN 83	15 JUN 83	22 JUN 83	29 JUN 83	6 JUL 83	13 JUL 83	20 JUL 83	27 JUL 83	3 AUG 83	10 AUG 83	17 AUG 83	24 AUG 83	31 AUG 83	7 SEP 83	14 SEP 83	21 SEP 83	28 SEP 83
3242	PULLING AND FASTENING ELECTRICAL CABLES FROM DB32 TO DIFFERENT DISTRIBUTION BOARDS AND INSTR CABINETS	85 E	12-JUN-83	12-JUN-83	1	1	X.I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
3126	TERMINATION OF CABLE IN TELEMETRY CABINET INTERFACE ROOM P13	85 E	13-JUN-83	13-JUN-83	1	1	X.I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
3127	TERMINATION OF CABINET IN ZENER BARRIER RACK INTERFACE ROOM P13	85 E	13-JUN-83	13-JUN-83	1	1	X.I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
3134	TERMINATION OF ELECTRICAL CABLE 323 P08	85 E	13-JUN-83	13-JUN-83	1	1	X.I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
3228	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85 E	13-JUN-83	13-JUN-83	1	1	X.I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
3230	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85 E	13-JUN-83	13-JUN-83	1	1	X.I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TCP2 EXTENSION SYSTEM : 88 03F																						
3243	PULLING AND FASTENING ELECTRICAL CABLES FROM DB324 TO DIFFERENT DISTRIBUTION BOARDS AND INSTR CABINETS	85 E	20-JUN-83	20-JUN-83	1	1	I	X.I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
3217	PULLING AND FASTENING ELECTRICAL CABLES FROM S 52,32,2,2&3 (NCC "A" & "B") TO MARSHALLING CABINET INTERF ROOM P13	85B7 E	30-JUN-83	30-JUN-83	1	1	I	I	IX	I	I	I	I	I	I	I	I	I	I	I	I	I
3120	TERMINATION OF CABLES IN ESD CABINET NO. 2 INTERFACE ROOM P13	85 E	1-JUL-83	1-JUL-83	1	1	I	I	I	IX	I	I	I	I	I	I	I	I	I	I	I	I
3135	TERMINATION OF ELECTRICAL CABLE IN DB 324 P08	85 E	1-JUL-83	1-JUL-83	1	1	I	I	I	IX	I	I	I	I	I	I	I	I	I	I	I	I
3229	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85 E	1-JUL-83	1-JUL-83	1	1	I	I	I	IX	I	I	I	I	I	I	I	I	I	I	I	I
3231	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85 E	2-JUL-83	2-JUL-83	1	1	I	I	I	IX	I	I	I	I	I	I	I	I	I	I	I	I
3241	TERMINATION OF ELECTRICAL CABLES IN MCC "A" EXTENSION S 52,32,2,2 -M32-TCP-2C	87 E	2-JUL-83	2-JUL-83	1	1	I	I	I	IX	I	I	I	I	I	I	I	I	I	I	I	I
TCP2 EXTENSION SYSTEM : 88 03E																						
3050	TIE-IN/EARTH CONNECTION M-50 TO EXISTING LOOP	50 E	27-JUN-83	27-JUN-83	1	1	I	I	I	X.I	I	I	I	I	I	I	I	I	I	I	I	I
3051	TIE-IN/EARTH CONNECTION P-53 TO EXISTING LOOP	53 E	27-JUN-83	27-JUN-83	1	1	I	I	I	X.I	I	I	I	I	I	I	I	I	I	I	I	I
TCP2 EXTENSION SYSTEM : 88 03H																						
3047	INSTALLATION OF J.B. & TRACE HEATING CABLES FOR CV1A-M02	85 E	14-JUN-83	14-JUN-83	1	1	I	I	XI	I	I	I	I	I	I	I	I	I	I	I	I	I
3048	INSTALLATION OF J.B. & TRACE HEATING CABLES IN COLUMN 5	65 E	16-JUN-83	16-JUN-83	1	1	I	I	IX	I	I	I	I	I	I	I	I	I	I	I	I	I
3026A	CLEANING OF CIRCUIT BREAKER FOR HEAT TRACING CIRCUIT BREAKER NO. 22,23,26 & 30	85 E	19-JUN-83	19-JUN-83	1	1	I	I	I	X.I	I	I	I	I	I	I	I	I	I	I	I	I

ISSUED FOR CONSTRUCTION

PRODUCED BY HAUGESUND - DE GROOT

SCHEDULE : LEVEL 3

SORTED BY PLANNED START

ID:50 PROJECT: TCP2

REPORT NUMBER :

DATASET : NETWORK

STRUCTURAL

TASK	Z	DESCRIPTION	AREA	SYS	EARLY	EARLY	7	14	21	28	5	12	19	26	2	9	16	23	30	REMARKS
COMP				TEM	START	FINISH	SEP	SEP	SEP	SEP	OCT	OCT	OCT	OCT	NOV	NOV	NOV	NOV	NOV	
							DUR	83	83	83	83	83	83	83	83	83	83	83	83	
7016	95	INSTALL SCAFFOLDING IN COLUMN 5 EL. 59,000. REMOVE PLASTIC NET FROM PIPE. REINSTALL PLASTIC NET AFTER RISER INSPECTION (BY DNV ?			7-SEP-83	6-SEP-83	5 T	I	I	I	I	I	I	I	I	I	I	I	I	1 SENT 24/8
7021	95	BLAST & PAINT 20" ODIN RISER FROM EL 103,000 TO EL 84,000			7-SEP-83	6-SEP-83	5 T	I	I	I	I	I	I	I	I	I	I	I	I	
7036	95	SANDBLASTING AND PAINTING OF 16" NEF RISER FROM EL 101500 TO EL 004000 COLUMN 5			7-SEP-83	6-SEP-83	2 T	I	I	I	I	I	I	I	I	I	I	I	I	
7037	#	REPAIR INSULATION ON TOP OF M50 WESTS LINES C-2006 EFS 18", C 2007 EFS 18"			7-SEP-83	8-SEP-83	2 TX	I	I	I	I	I	I	I	I	I	I	I	I	
7045	#	INSTALL 50X5 STEEL ROUND HATCHES UPPER DECK M50 & 4 OF 2" DRAIN PIPES TO DRAIN TROUGH			7-SEP-83	11-SEP-83	5 TXXX	I	I	I	I	I	I	I	I	I	I	I	I	
7046	#	REPAIR INSULATION ON EXISTING 4" LINE TOP OF C/17A/B/C TIE IN FROM C2295 EB 3" GI C2209 EB 3" GI AND C2294 EB 3" GI.			7-SEP-83	8-SEP-83	2 TX	I	I	I	I	I	I	I	I	I	I	I	I	
7056	95	WORK ACCORDING TO NOV PUNCHLIST ON NEF RISER (ITEM 0-14) LEVEL 54.00 M TO 113.00 M.			7-SEP-83	6-SEP-83	2 T	I	I	I	I	I	I	I	I	I	I	I	I	
7057	80	WORK ACCORDING TO DNV PUNCHLIST ON ODIN RISER (ITEM 1-7) LEVELL 69.00 M TO 113.00 M.			7-SEP-83	6-SEP-83	2 T	I	I	I	I	I	I	I	I	I	I	I	I	
7059	#	PREFAB. & INSTALL NEW LIGHTING SUPPORTS TOP M50 (WEST)			7-SEP-83	8-SEP-83	2 TX	I	I	I	I	I	I	I	I	I	I	I	I	
7060	#	INSTALL CHAIN ON 4 LADDERS TOP OF M50. INSTALL CHAIN ON 1 LADDER FROM MEZZ TO M DECK M50. INSTALL CHAIN ON 1 LADDER ON MAIN DECK M50. INSTALL CHAIN ON 3 LADDERS CELLAR DECK P53. INSTALL GATES ON			7-SEP-83	8-SEP-83	2 TX	I	I	I	I	I	I	I	I	I	I	I	I	
7061	#	RELOCATE LIGHTING SUPPORT SOUTH DOOR M50 MAIN DECK.			7-SEP-83	8-SEP-83	2 TX	I	I	I	I	I	I	I	I	I	I	I	I	
0040	90	PAINTING AND TOUCH UP OF STEEL STRUCTURES IN M50	88	25A	7-SEP-83	8-SEP-83	16 CXI.	I	I	I	I	I	I	I	I	I	I	I	
0041	90	PAINTING AND TOUCH UP OF STEEL STRUCTURES IN P53	88	25A	7-SEP-83	7-SEP-83	5 C	I	I	I	I	I	I	I	I	I	I	I	I	
0042	90	PAINTING AND TOUCH UP OF R ERECTED STEEL STRUCTURES IN AREA 05	88	25A	10-SEP-83	10-SEP-83	9 CCCCI.	I	I	I	I	I	I	I	I	I	I	I	

3 WEEK LOOK-AHEAD BY DISCIPLINE & SYSTEM

APPENDIX 5

APPENDIX 5

HOOK UP
PROGRESS CURVES

CONTENT:

PROGRESS CURVE	ELECTRICAL
PROGRESS CURVE	INSTRUMENT
PROGRESS CURVE	PIPING
PROGRESS CURVE	STRUCTURAL

ELECTRICAL

DATE	PERCENT COMPLETE										CUML %PLAN	WEEKLY %PLAN	ACT %COMP	
	0	10	20	30	40	50	60	70	80	90				
1-JUN	I	I	I	I	I	I	I	I	I	I	I	5.17	5.17	1.75
3-JUN	I	I	I	I	I	I	I	I	I	I	I	10.33	5.16	2.42
5-JUN	I	I	I	I	I	I	I	I	I	I	I	15.24	4.92	5.33
7-JUN	I	I	I	I	I	I	I	I	I	I	I	20.24	5.00	11.10
9-JUN	I	I	I	I	I	I	I	I	I	I	I	25.22	4.98	15.31
11-JUN	I	I	I	I	I	I	I	I	I	I	I	30.31	5.09	21.10
13-JUN	I	I	I	I	I	I	I	I	I	I	I	35.20	4.89	25.29
15-JUN	I	I	I	I	I	I	I	I	I	I	I	37.81	2.61	27.90
17-JUN	I	I	I	I	I	I	I	I	I	I	I	40.51	2.70	34.30
19-JUN	I	I	I	I	I	I	I	I	I	I	I	43.20	2.69	38.10
21-JUN	I	I	I	I	I	I	I	I	I	I	I	45.45	2.25	45.60
23-JUN	I	I	I	I	I	I	I	I	I	I	I	47.85	2.40	0.00
25-JUN	I	I	I	I	I	I	I	I	I	I	I	49.79	1.94	0.00
27-JUN	I	I	I	I	I	I	I	I	I	I	I	52.40	2.61	0.00
29-JUN	I	I	I	I	I	I	I	I	I	I	I	54.64	2.24	0.00
1-JUL	I	I	I	I	I	I	I	I	I	I	I	57.17	2.53	0.00
3-JUL	I	I	I	I	I	I	I	I	I	I	I	59.36	2.19	0.00
5-JUL	I	I	I	I	I	I	I	I	I	I	I	60.87	1.51	0.00
7-JUL	I	I	I	I	I	I	I	I	I	I	I	62.40	1.61	0.00
9-JUL	I	I	I	I	I	I	I	I	I	I	I	64.09	1.60	0.00
11-JUL	I	I	I	I	I	I	I	I	I	I	I	64.15	2.87	0.00
13-JUL	I	I	I	I	I	I	I	I	I	I	I	67.67	1.51	0.00
15-JUL	I	I	I	I	I	I	I	I	I	I	I	70.38	2.71	0.00
17-JUL	I	I	I	I	I	I	I	I	I	I	I	72.63	2.26	0.00
19-JUL	I	I	I	I	I	I	I	I	I	I	I	75.20	2.57	0.00
21-JUL	I	I	I	I	I	I	I	I	I	I	I	77.69	2.48	0.00
23-JUL	I	I	I	I	I	I	I	I	I	I	I	79.13	1.44	0.00
25-JUL	I	I	I	I	I	I	I	I	I	I	I	80.62	1.49	0.00
27-JUL	I	I	I	I	I	I	I	I	I	I	I	82.43	1.81	0.00
29-JUL	I	I	I	I	I	I	I	I	I	I	I	84.12	1.69	0.00
31-JUL	I	I	I	I	I	I	I	I	I	I	I	85.59	1.47	0.00
2-AUG	I	I	I	I	I	I	I	I	I	I	I	87.06	1.47	0.00
4-AUG	I	I	I	I	I	I	I	I	I	I	I	88.53	1.47	0.00
6-AUG	I	I	I	I	I	I	I	I	I	I	I	90.00	1.47	0.00
8-AUG	I	I	I	I	I	I	I	I	I	I	I	91.46	1.46	0.00
10-AUG	I	I	I	I	I	I	I	I	I	I	I	92.92	1.46	0.00
12-AUG	I	I	I	I	I	I	I	I	I	I	I	94.38	1.46	0.00
14-AUG	I	I	I	I	I	I	I	I	I	I	I	95.84	1.46	0.00
16-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.68	0.00
18-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
20-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
22-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
24-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
26-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
28-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
30-AUG	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
1-SEP	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
3-SEP	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
5-SEP	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
7-SEP	I	I	I	I	I	I	I	I	I	I	I	96.52	0.00	0.00
9-SEP	I	I	I	I	I	I	I	I	I	I	I	99.14	2.62	0.00
11-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.86	0.00
13-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00

PRODUCED BY HAUGESUND - DE GROOT

PROJECT S CURVE

SORTED BY PLANNED START

ID:50 PROJECT: TCP2

REPORT NUMBER: TCURV

DATASET: CURV1

INSTRUMENT

DATE	PERCENT COMPLETE										CUML XPLAN	WEEKLY XPLAN	ACT XCOMP	
	0	10	20	30	40	50	60	70	80	90				
1-JUN	I	I	I	I	I	I	I	I	I	I	I	0.13	0.13	1.30
3-JUN	I	I	I	I	I	I	I	I	I	I	I	0.25	0.12	3.10
5-JUN	I	I	I	I	I	I	I	I	I	I	I	0.37	0.12	5.40
7-JUN	I	I	I	I	I	I	I	I	I	I	I	1.08	0.71	7.00
9-JUN	I	I	I	I	I	I	I	I	I	I	I	2.36	1.28	7.89
11-JUN	I	I	I	I	I	I	I	I	I	I	I	3.64	1.28	13.45
13-JUN	I	I	I	I	I	I	I	I	I	I	I	4.91	1.27	14.72
15-JUN	I	I	I	I	I	I	I	I	I	I	I	7.89	2.98	17.70
17-JUN	I	I	I	I	I	I	I	I	I	I	I	10.86	2.97	22.30
19-JUN	I	I	I	I	I	I	I	I	I	I	I	13.82	2.97	27.40
21-JUN	I	I	I	I	I	I	I	I	I	I	I	16.79	2.96	33.40
23-JUN	I	I	I	I	I	I	I	I	I	I	I	19.75	2.96	0.00
25-JUN	I	I	I	I	I	I	I	I	I	I	I	22.69	2.95	0.00
27-JUN	I	I	I	I	I	I	I	I	I	I	I	25.65	2.96	0.00
29-JUN	I	I	I	I	I	I	I	I	I	I	I	28.60	2.95	0.00
1-JUL	I	I	I	I	I	I	I	I	I	I	I	31.53	2.93	0.00
3-JUL	I	I	I	I	I	I	I	I	I	I	I	34.46	2.93	0.00
5-JUL	I	I	I	I	I	I	I	I	I	I	I	37.40	2.95	0.00
7-JUL	I	I	I	I	I	I	I	I	I	I	I	40.29	2.88	0.00
9-JUL	I	I	I	I	I	I	I	I	I	I	I	43.15	2.87	0.00
11-JUL	I	I	I	I	I	I	I	I	I	I	I	46.06	2.91	0.00
13-JUL	I	I	I	I	I	I	I	I	I	I	I	48.97	2.92	0.00
15-JUL	I	I	I	I	I	I	I	I	I	I	I	51.89	2.92	0.00
17-JUL	I	I	I	I	I	I	I	I	I	I	I	54.81	2.92	0.00
19-JUL	I	I	I	I	I	I	I	I	I	I	I	57.73	2.92	0.00
21-JUL	I	I	I	I	I	I	I	I	I	I	I	60.69	2.94	0.00
23-JUL	I	I	I	I	I	I	I	I	I	I	I	63.52	2.83	0.00
25-JUL	I	I	I	I	I	I	I	I	I	I	I	66.37	2.86	0.00
27-JUL	I	I	I	I	I	I	I	I	I	I	I	69.32	2.94	0.00
29-JUL	I	I	I	I	I	I	I	I	I	I	I	72.12	2.80	0.00
31-JUL	I	I	I	I	I	I	I	I	I	I	I	74.99	2.87	0.00
2-AUG	I	I	I	I	I	I	I	I	I	I	I	77.93	2.94	0.00
4-AUG	I	I	I	I	I	I	I	I	I	I	I	80.86	2.93	0.00
6-AUG	I	I	I	I	I	I	I	I	I	I	I	83.80	2.95	0.00
8-AUG	I	I	I	I	I	I	I	I	I	I	I	84.59	0.79	0.00
10-AUG	I	I	I	I	I	I	I	I	I	I	I	85.74	1.14	0.00
12-AUG	I	I	I	I	I	I	I	I	I	I	I	86.65	0.92	0.00
14-AUG	I	I	I	I	I	I	I	I	I	I	I	87.37	0.71	0.00
16-AUG	I	I	I	I	I	I	I	I	I	I	I	88.06	0.69	0.00
18-AUG	I	I	I	I	I	I	I	I	I	I	I	88.98	0.92	0.00
20-AUG	I	I	I	I	I	I	I	I	I	I	I	90.03	1.05	0.00
22-AUG	I	I	I	I	I	I	I	I	I	I	I	91.16	1.13	0.00
24-AUG	I	I	I	I	I	I	I	I	I	I	I	92.25	1.09	0.00
26-AUG	I	I	I	I	I	I	I	I	I	I	I	93.33	1.09	0.00
28-AUG	I	I	I	I	I	I	I	I	I	I	I	94.37	1.04	0.00
30-AUG	I	I	I	I	I	I	I	I	I	I	I	95.44	1.06	0.00
1-SEP	I	I	I	I	I	I	I	I	I	I	I	96.52	1.09	0.00
3-SEP	I	I	I	I	I	I	I	I	I	I	I	97.61	1.09	0.00
5-SEP	I	I	I	I	I	I	I	I	I	I	I	98.63	1.01	0.00
7-SEP	I	I	I	I	I	I	I	I	I	I	I	99.55	0.93	0.00
9-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.45	0.00
11-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
13-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00

PRODUCED BY HAUGESUND - DE GROOT

PROJECT S CURVE

SORTED BY PLANNED START

ID:50 PROJECT: TCP2

REPORT NUMBER: 1 CURV

DATASET: CURV1

P I P I N G

DATE	PERCENT COMPLETE											CUML XPLAN	WEEKLY XPLAN	ACT XCOMP	
	0	10	20	30	40	50	60	70	80	90	100				
1-JUN	I	I	I	I	I	I	I	I	I	I	I	I	0.57	0.57	0.00
3-JUN	I	I	I	I	I	I	I	I	I	I	I	I	1.13	0.57	0.30
5-JUN	I	I	I	I	I	I	I	I	I	I	I	I	1.72	0.58	1.10
7-JUN	I	I	I	I	I	I	I	I	I	I	I	I	2.39	0.68	1.40
9-JUN	I	I	I	I	I	I	I	I	I	I	I	I	3.12	0.73	2.00
11-JUN	I	I	I	I	I	I	I	I	I	I	I	I	3.86	0.74	2.20
13-JUN	I	I	I	I	I	I	I	I	I	I	I	I	4.59	0.73	3.00
15-JUN	I	I	I	I	I	I	I	I	I	I	I	I	7.54	2.95	3.10
17-JUN	I	I	I	I	I	I	I	I	I	I	I	I	10.45	2.91	4.30
19-JUN	I	I	I	I	I	I	I	I	I	I	I	I	13.33	2.08	6.10
21-JUN	I	I	I	I	I	I	I	I	I	I	I	I	16.25	2.92	8.40
23-JUN	I	I	I	I	I	I	I	I	I	I	I	I	19.21	2.95	0.00
25-JUN	I	I	I	I	I	I	I	I	I	I	I	I	22.15	2.95	0.00
27-JUN	I	I	I	I	I	I	I	I	I	I	I	I	25.08	2.93	0.00
29-JUN	I	I	I	I	I	I	I	I	I	I	I	I	28.00	2.93	0.00
1-JUL	I	I	I	I	I	I	I	I	I	I	I	I	30.96	2.96	0.00
3-JUL	I	I	I	I	I	I	I	I	I	I	I	I	33.91	2.95	0.00
5-JUL	I	I	I	I	I	I	I	I	I	I	I	I	36.84	2.92	0.00
7-JUL	I	I	I	I	I	I	I	I	I	I	I	I	39.79	2.95	0.00
9-JUL	I	I	I	I	I	I	I	I	I	I	I	I	42.78	2.99	0.00
11-JUL	I	I	I	I	I	I	I	I	I	I	I	I	45.75	2.97	0.00
13-JUL	I	I	I	I	I	I	I	I	I	I	I	I	48.74	2.98	0.00
15-JUL	I	I	I	I	I	I	I	I	I	I	I	I	51.66	2.93	0.00
17-JUL	I	I	I	I	I	I	I	I	I	I	I	I	54.60	2.94	0.00
19-JUL	I	I	I	I	I	I	I	I	I	I	I	I	57.51	2.91	0.00
21-JUL	I	I	I	I	I	I	I	I	I	I	I	I	60.48	2.97	0.00
23-JUL	I	I	I	I	I	I	I	I	I	I	I	I	63.46	2.99	0.00
25-JUL	I	I	I	I	I	I	I	I	I	I	I	I	66.43	2.97	0.00
27-JUL	I	I	I	I	I	I	I	I	I	I	I	I	69.36	2.93	0.00
29-JUL	I	I	I	I	I	I	I	I	I	I	I	I	72.30	2.93	0.00
31-JUL	I	I	I	I	I	I	I	I	I	I	I	I	75.21	2.91	0.00
2-AUG	I	I	I	I	I	I	I	I	I	I	I	I	78.13	2.92	0.00
4-AUG	I	I	I	I	I	I	I	I	I	I	I	I	81.07	2.93	0.00
6-AUG	I	I	I	I	I	I	I	I	I	I	I	I	83.96	2.90	0.00
8-AUG	I	I	I	I	I	I	I	I	I	I	I	I	86.79	2.83	0.00
10-AUG	I	I	I	I	I	I	I	I	I	I	I	I	89.76	2.97	0.00
12-AUG	I	I	I	I	I	I	I	I	I	I	I	I	92.46	2.70	0.00
14-AUG	I	I	I	I	I	I	I	I	I	I	I	I	95.26	2.01	0.00
16-AUG	I	I	I	I	I	I	I	I	I	I	I	I	98.11	2.05	0.00
18-AUG	I	I	I	I	I	I	I	I	I	I	I	I	99.28	1.17	0.00
20-AUG	I	I	I	I	I	I	I	I	I	I	I	I	99.83	0.55	0.00
22-AUG	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.17	0.00
24-AUG	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
26-AUG	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
28-AUG	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
30-AUG	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
1-SEP	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
3-SEP	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
5-SEP	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
7-SEP	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
9-SEP	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
11-SEP	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
13-SEP	I	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00

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 PRODUCED BY HAUGESUND - DE GROOT
 ID:50 PROJECT: TCP2
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 PROJECT 8 CURVE
 REPORT NUMBER : TCURV
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 SORTED BY PLANNED START
 DATASET : CURV1
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STRUCTURAL

DATE	PERCENT COMPLETE										DUML %PLAN	WEEKLY %PLAN	ACT %COMP	
	0	10	20	30	40	50	60	70	80	90				
1-JUN	I	I	I	I	I	I	I	I	I	I	I	2.31	2.31	0.52
3-JUN	I	I	I	I	I	I	I	I	I	I	I	4.63	2.31	1.13
5-JUN	I	I	I	I	I	I	I	I	I	I	I	7.02	2.40	2.22
7-JUN	I	I	I	I	I	I	I	I	I	I	I	9.44	2.42	4.64
9-JUN	I	I	I	I	I	I	I	I	I	I	I	11.68	2.24	6.88
11-JUN	I	I	I	I	I	I	I	I	I	I	I	14.07	2.39	9.27
13-JUN	I	I	I	I	I	I	I	I	I	I	I	16.61	2.54	11.81
15-JUN	I	I	I	I	I	I	I	I	I	I	I	19.20	2.60	14.40
17-JUN	I	I	I	I	I	I	I	I	I	I	I	21.86	2.66	15.80
19-JUN	I	I	I	I	I	I	I	I	I	I	I	24.00	2.14	17.70
21-JUN	I	I	I	I	I	I	I	I	I	I	I	25.75	1.75	19.90
23-JUN	I	I	I	I	I	I	I	I	I	I	I	26.88	1.13	0.00
25-JUN	I	I	I	I	I	I	I	I	I	I	I	28.05	1.17	0.00
27-JUN	I	I	I	I	I	I	I	I	I	I	I	29.40	1.35	0.00
29-JUN	I	I	I	I	I	I	I	I	I	I	I	30.98	1.59	0.00
1-JUL	I	I	I	I	I	I	I	I	I	I	I	33.56	2.58	0.00
3-JUL	I	I	I	I	I	I	I	I	I	I	I	36.11	2.55	0.00
5-JUL	I	I	I	I	I	I	I	I	I	I	I	38.74	2.63	0.00
7-JUL	I	I	I	I	I	I	I	I	I	I	I	41.18	2.44	0.00
9-JUL	I	I	I	I	I	I	I	I	I	I	I	43.63	2.44	0.00
11-JUL	I	I	I	I	I	I	I	I	I	I	I	46.07	2.44	0.00
13-JUL	I	I	I	I	I	I	I	I	I	I	I	48.51	2.44	0.00
15-JUL	I	I	I	I	I	I	I	I	I	I	I	50.95	2.44	0.00
17-JUL	I	I	I	I	I	I	I	I	I	I	I	53.40	2.44	0.00
19-JUL	I	I	I	I	I	I	I	I	I	I	I	55.83	2.44	0.00
21-JUL	I	I	I	I	I	I	I	I	I	I	I	58.30	2.46	0.00
23-JUL	I	I	I	I	I	I	I	I	I	I	I	60.76	2.46	0.00
25-JUL	I	I	I	I	I	I	I	I	I	I	I	63.23	2.46	0.00
27-JUL	I	I	I	I	I	I	I	I	I	I	I	65.59	2.36	0.00
29-JUL	I	I	I	I	I	I	I	I	I	I	I	67.95	2.36	0.00
31-JUL	I	I	I	I	I	I	I	I	I	I	I	70.47	2.51	0.00
2-AUG	I	I	I	I	I	I	I	I	I	I	I	73.13	2.67	0.00
4-AUG	I	I	I	I	I	I	I	I	I	I	I	75.80	2.67	0.00
6-AUG	I	I	I	I	I	I	I	I	I	I	I	78.47	2.67	0.00
8-AUG	I	I	I	I	I	I	I	I	I	I	I	81.12	2.65	0.00
10-AUG	I	I	I	I	I	I	I	I	I	I	I	83.74	2.61	0.00
12-AUG	I	I	I	I	I	I	I	I	I	I	I	85.98	2.25	0.00
14-AUG	I	I	I	I	I	I	I	I	I	I	I	88.25	2.26	0.00
16-AUG	I	I	I	I	I	I	I	I	I	I	I	90.51	2.26	0.00
18-AUG	I	I	I	I	I	I	I	I	I	I	I	92.77	2.26	0.00
20-AUG	I	I	I	I	I	I	I	I	I	I	I	95.04	2.26	0.00
22-AUG	I	I	I	I	I	I	I	I	I	I	I	96.72	1.68	0.00
24-AUG	I	I	I	I	I	I	I	I	I	I	I	97.81	1.10	0.00
26-AUG	I	I	I	I	I	I	I	I	I	I	I	98.91	1.10	0.00
28-AUG	I	I	I	I	I	I	I	I	I	I	I	100.00	1.10	0.00
30-AUG	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
1-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
3-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
5-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
7-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
9-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
11-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00
13-SEP	I	I	I	I	I	I	I	I	I	I	I	100.00	0.00	0.00

APPENDIX 6

APPENDIX 6

HOOK UP
CUMULATIVE MANHOURS

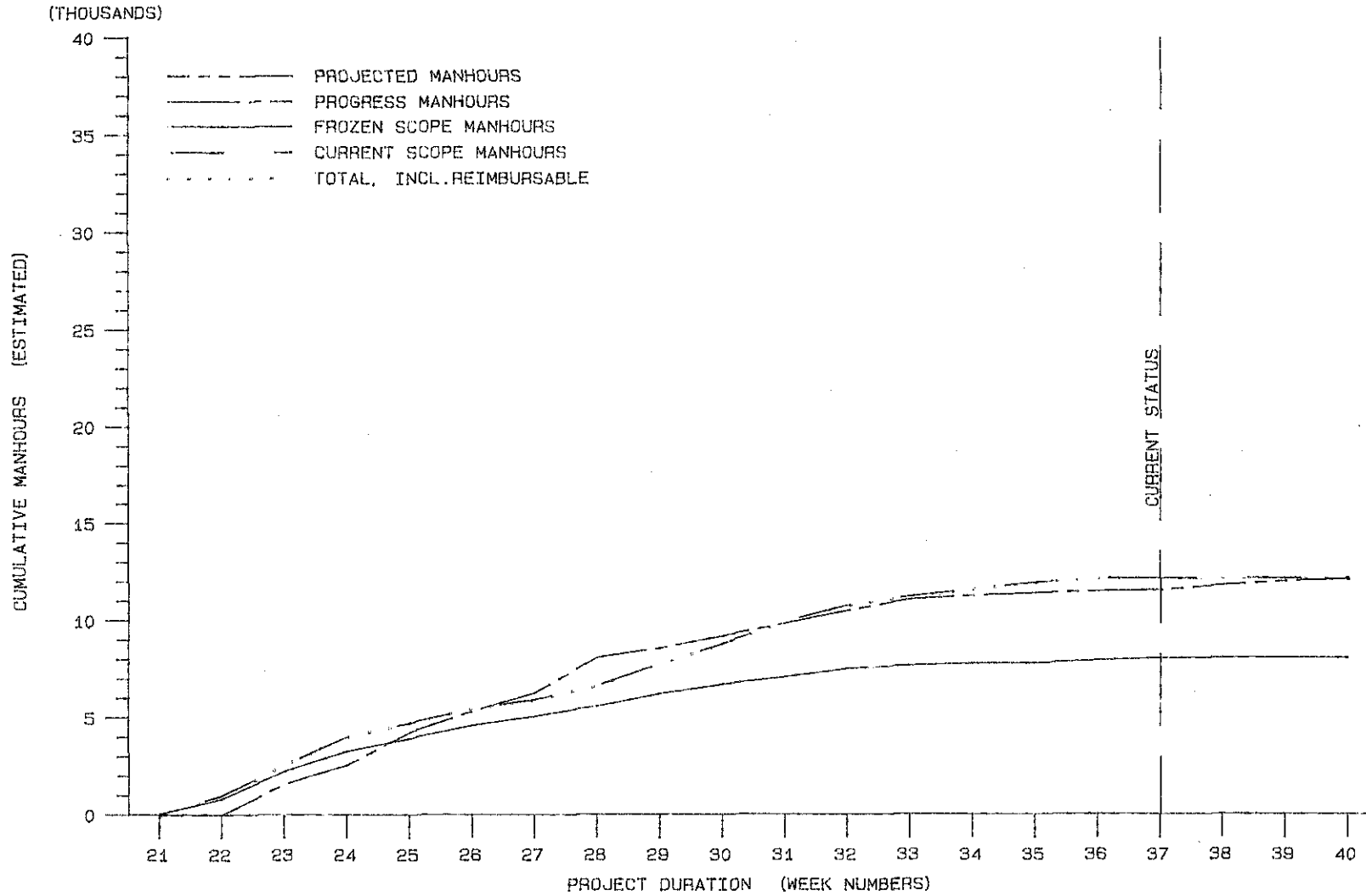
CONTENT:

CUMULATIVE MANHOURS S-CURVE	ELECTRICAL
CUMULATIVE MANHOURS S-CURVE	INSTRUMENT
CUMULATIVE MANHOURS S-CURVE	PIPING
CUMULATIVE MANHOURS S-CURVE	STRUCTURAL

CUMULATIVE MANHOUR 'S' CURVE

TCP2 EXTENSION PROJECT

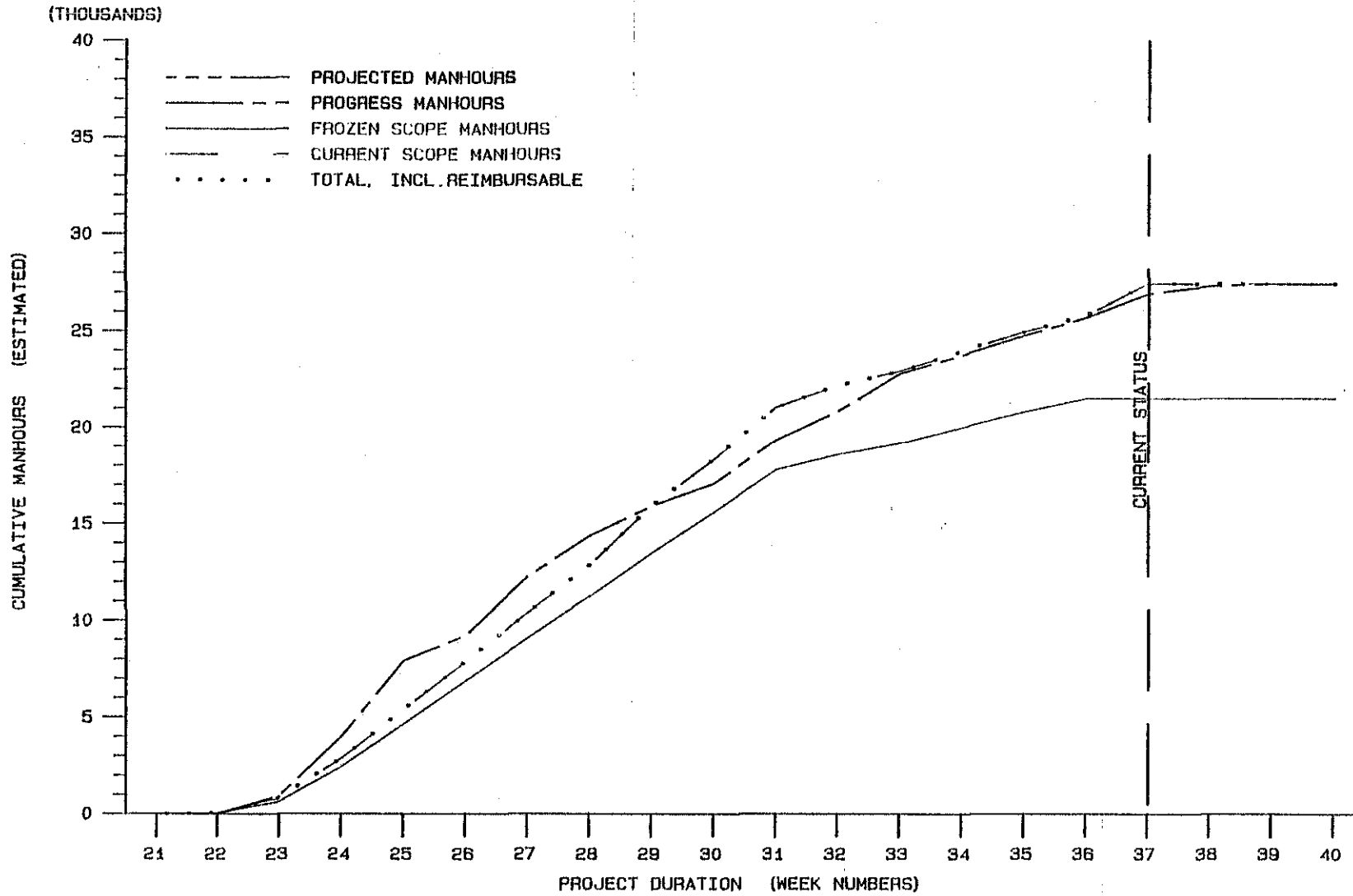
DISCIPLINE - ELECTRICAL



CUMULATIVE MANHOUR 'S' CURVE

TCP2 EXTENSION PROJECT

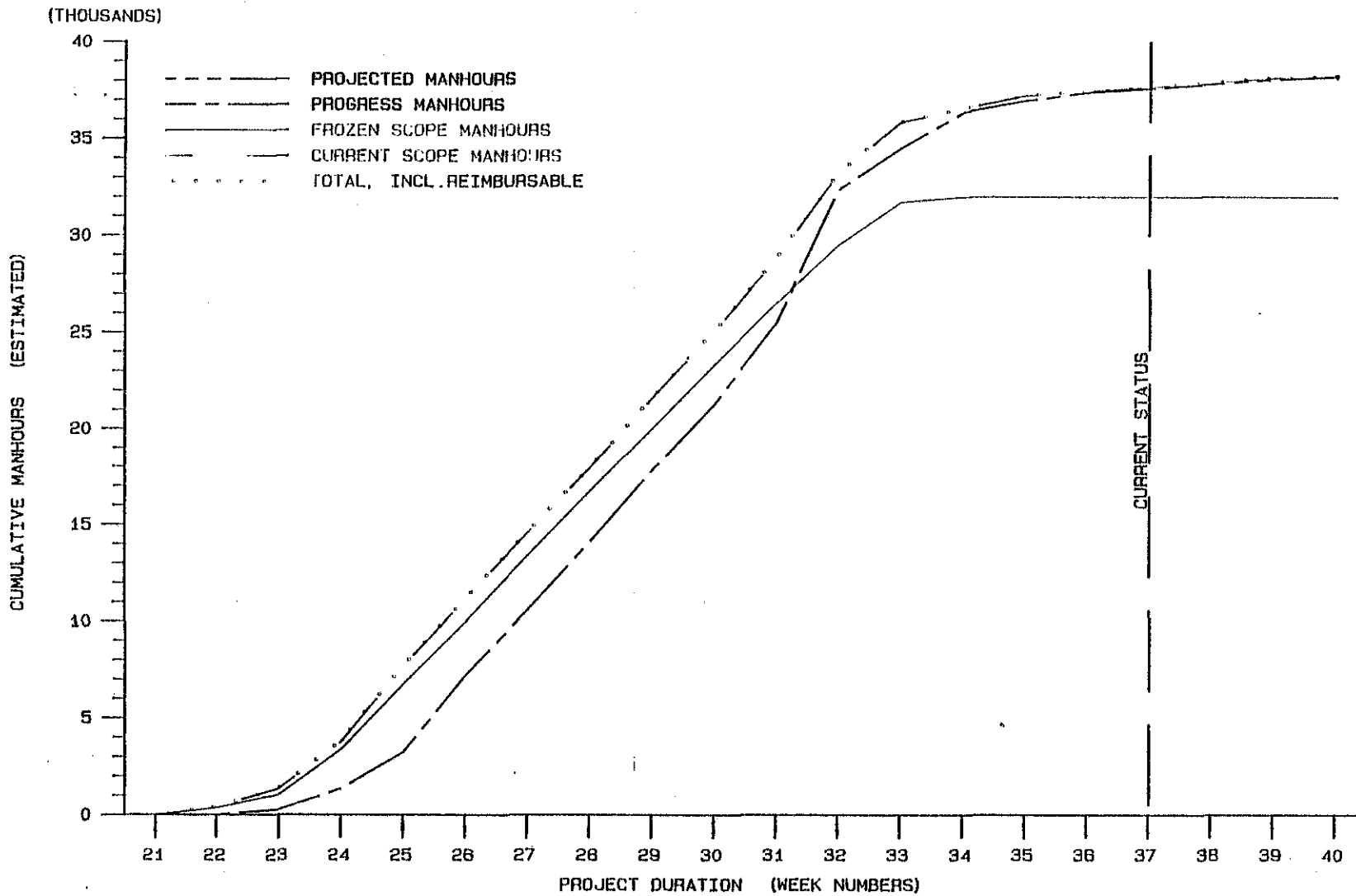
DISCIPLINE - INSTRUMENT



CUMULATIVE MANHOUR 'S' CURVE

TCP2 EXTENSION PROJECT

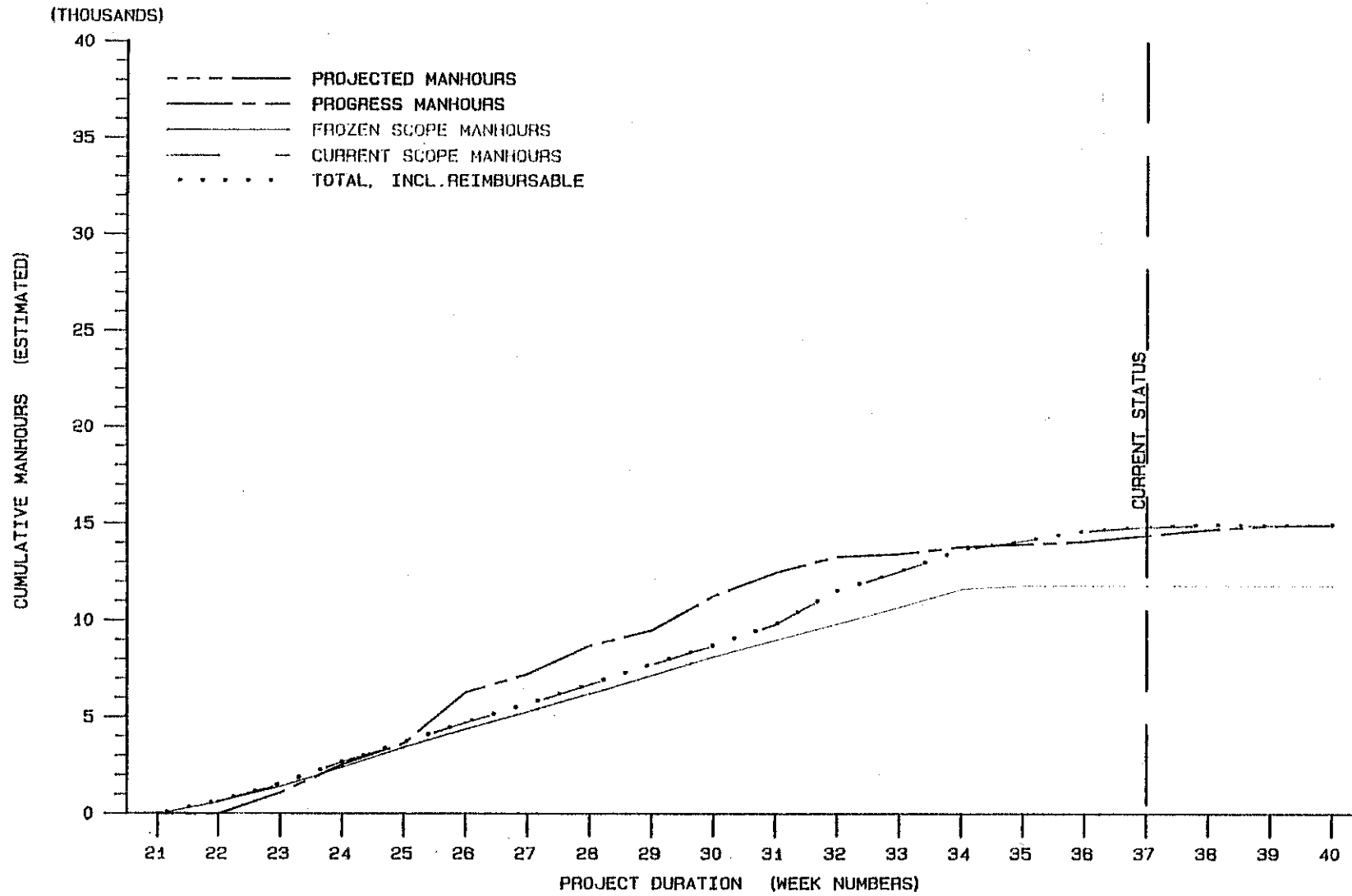
DISCIPLINE - PIPING



CUMULATIVE MANHOUR 'S' CURVE

TCP2 EXTENSION PROJECT

DISCIPLINE - STRUCTURAL



APPENDIX 7

APPENDIX 7

FLOTEL BID EVALUATION

CONTENT:

1. SUMMARY
2. PRESCREENING
3. TECHNICAL EVALUATION
4. COMMERCIAL COMPARISON
5. CONCLUSION

APPENDIX 7

FLOTEL BID EVALUATION

1 SUMMARY

The tender documents for the Flotel was issued as a combined tender for TCP-2 Extension and Heimdal with the following three options:

- 1) Services for TCP-2 Extension only.
- 2) Services for Heimdal only.
- 3) Combined services for Heimdal and TCP-2 Extension.

After bid opening on 22.01.82, and subsequent meetings between TCP-2 Extension and Heimdal projects, the situation was the following:

- The best offer for TCP-2 Extension only (option 1) and combined services (option 3) was Stavanger Drilling tender, but Henrik Ibsen would not meet Heimdal Project requirements.

Because of different requirements, each project group negotiated separately with the tenders. The two most attractive tenders for TCP-2 Extension was W. Wilhelmsen and Stavanger Drilling.

At the date of 31st March 1982, Stavanger Drilling's offer was still unchanged but the availability of Henrik Ibsen was not anymore guaranteed after 31st March 1982.

At the same date of 31st March 1982, W. Wilhelmsen reduced their rates for Treasure Supporter.

The contract was then awarded to W. Wilhelmsen.

2 PRE-SCREENING

Bids were received on 22.01.82 from the following companies:

- W. Wilhelmsen
- Stavanger Drilling
- Consafe
- Rasmussen
- Jahre
- I. Larsen

All companies except Rasmussen, quoted for the three alternatives requested in the tender documents:

1. Services for TCP-2 Extension only.
2. Services for Heimdal only.
3. Combined services for TCP-2 Extension and Heimdal.

This analysis outlines TCP-2 Extension requirements and recommendations based on:

- Delivery date
- Price
- Flotel specification
- Compliance with regulations

The conclusion was that Treasure Supporter (W. Wilhelmsen) and Henrik Ibsen (Stavanger Drilling) fulfilled the projects requirements.

2.1 DELIVERY DATE - CRITERIA

The required delivery time of the flotel was 25th May 1983.

Because of potential problems to meet this date, the following companies were excluded:

- I. Larsen (new building by Aker Verdal) end of trial test 15th June 1983 + order not yet confirmed.
- Jahre (new building by Chantiers de l'Atlantique) end of trial test 15th May 1983.

2.2 ECONOMICAL CRITERIA

Based on alternate 1 - TCP 2 Extension only

- Appraisal based on 153 days charter
- Excluding anchor handling and catering costs
- Excluding specific requirements
- Without escalation
- Price ranking was, for TCP-2 Extension only.

	<u>Total Comparable Cost</u>
W. Wilhelmsen 425.000 KR/D + 10.000.000 MOB.	76.555 KNOK
Stavanger Drilling 390.000 KR/D	59.670 KNOK
Consafe 82.500 \$/D + 2.500.000 \$ MOB	88.500 KNOK
Rasmussen No quotation for TCP 2 Extension	
Jahre 495000 KR/D	75.735 KNOK
I. Larsen 150.000 \$/D	1.342.500 KNOK

The two best offers being then for alternative 1:

1. Stavanger Drilling (Henrik Ibsen)
2. W. Wilhelmsen (Treasure Supporter).

Based on alternative 3 - Combined services TCP-2 Extension
+ Heimdal

Same reservations as for 2.1. above.

	<u>Comparable total cost for TCP 2 Ext. only</u>
W. Wilhelmsen 380.000 KR/D + 29.000.000 KR compensation at TCP 2 Demobilisation (Assuming the compensation to be shared by TCP 2/Heimdal prorata to duration)	65.816 KNOK 58.140 if compensation is supported by Heimdal
Stavanger Drilling 375.000 KR/D	57.375 KNOK
Consafe 78.500 \$ D 5,85	70.261 KNOK

Overall price ranking for TCP 2 Extension project

57375 KNOK (1) Stavanger Drilling	combined (alt. 3)
59670 KNOK (2) Stavanger Drilling	(alt. 1)
65816 KNOK (3) W. Wilhelmsen	combined (alt. 3)
70261 KNOK (4) Consafe	combined (alt. 3)

2.3 FLOTEL SPECIFICATION CRITERIA

The following vessels are evaluated:

- Henrik Ibsen
- Treasure Supporter

Attention was paid on the following items:

1. Bed capacity at EAN disposal
2. Offices facilities
3. Toilets NB and location at EAN disposal
4. Coffee room and location at EAN disposal
5. Indoor storage
6. Outdoor storage
7. Workshop
8. Cranes
9. Bridge
10. Conference room

See tabulation hereafter.

ITEM	TCP 2 EXTENSION REQUIREMENT	HENRIK IBSEN	TREASURE SUPPORTER
1 Beds	250	450	425
2 Offices	Mini.30 desks Free access with work clothes	OK. 15 offices inside	OK. Containers outside
3 Toilets	Mini. 12	OK. 11 toilets inside	OK. Containers outside
4 Coffee room	To feed 250 persons in maxi. 1 hour, maxi. break 15 min. pr. person	OK. Arranged inside	OK. Containers outside
5 Indoor storage	150 m ²	OK. But access restriction	OK.
6 Outdoor storage	Suitable for 20 containers with free access	Only 8 containers outdoor (equal 16 small containers)	OK. 23 containers
7 Work Shop	Not required	Existing	Existing
8 Cranes	2 marine cranes access to TCP 2 not required	-	-
9 Bridge	Manouvring shall not necessitate flotel crane	OK.	OK.
10 Conference room	- One small for company use - One big as per regulation	OK.	OK.

3 TECHNICAL EVALUATION

Since evaluation has started, TCP-2 Extension has paid attention to Henrik Ibsen while Heimdal has paid attention to Treasure Supporter and Polycastle.

3.1 Henrik Ibsen status

General

The rig was reported to comply with the new regulation.

We found two items not in order:

- the FIFI equipment on Helideck
- the pick-up boat which would be exchanged.

Otherwise, certificats of the rig where copied and requested by Safety Department and Verneombud representatives.

In addition, smoke detector have to be installed to comply with the EAN Safety Manual.

Anchor system

Stavanger Drilling presented an anchor pattern on the Frigg map showing the new pipelines routes, and performed the calculation of the anchor system, both were acceptable.

Bridge criteria of enviromental condition, basis of calculation of anchor system by NFSI are very conservative as they include the 100-year condition in May and October. Under certain weather conditions, the bridge end shall be lifted because the anchor line tension is higher than 1/4 of the anchor wire breaking strength.

Other facilities

Offices, conference room, coffee room, extra toilets, proposed Stavanger Drilling are acceptable and of good standard.

The only point where H.I. does not comply with our original requirement is the capacity to store maximum 8 containers on the deck (instead of 20 required).

3.2 TREASURE SUPPORTER STATUS

The rig was used during TCP-2 Compression Hook-Up, and can be accepted without any modification.

Necessary modifications to comply with the new regulations will be made.

3.3 CONCLUSION

- Technically, both flotels are acceptable and suitable for the planned services.

4 COMMERCIAL COMPARISON

The following tabulation takes into account the new rate and condition proposed by W. Wilhelmsen on 31st March 1982:

- Daily rate of 370.000 NOK
- Mobilization/demobilization at Frigg
- Cost of replacement of anchor wires if any to be borne by Contractor

Its conclusion is clearly in favour of W. Wilhelmsen.

Company	Flotel	Daily rate	Lum 4 1/2	Sum 5 1/2	Adjustment	Total
W. Wilhelmsen	Treasure Supporter	370.000	50,8	62,1		62,1
Stvgr.Drilling	Henrik Ibsen	390.000	53,5	65,4	1,7	67,1

Adjustment

Additions to Stavanger Drilling:

MOB at Frigg: 3 days at 390.000 = 1,2 KNOK

Anchor wire replacements = 0,5 "

TOTAL = 1,7 KNOK

5 CONCLUSION

From a technical point of view both Henrik Ibsen and Treasure Supporter was found acceptable, but W. Wilhelmsen's Treasure Supporter was recommended because of the lowest price.