CHEVRON USA, INC.
CONOCO, INC.
MINERALS MANAGEMENT SERVICE
MOBIL EXPLORATION & PRODUCTION SERVICES, INC.
NKK AMERICA, INC.

APPENDIX A - COST DATA

A STUDY ON THE FEASIBILITY OF PRODUCTION, STORAGE AND LOADING SYSTEMS IN THE NORTH ALEUTIAN BASIN (OCS LEASE SALE 92)

SEPTEMBER 1985

BRIAN WATT ASSOCIATES, INC.
Consulting Engineers

284/BWA

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A.1.0 INTRODUCTION

This appendix provides an expanded derivation of the costs generated for alternative drilling and production systems for use in the OCS Lease Sale 92 area in the North Aleutian Basin area, offshore Alaska. In the main report, summary tables of the appropriate costs were provided.

This appendix provides original and unedited handwritten cost calculations. Because of the many concepts costed in this study, for various water depths and production rates, costs are only developed once. Where the same costs occur in a number of different concepts, the location of the appropriate cost is referenced.

The approach taken in the Appendix has been to take the summary tables with their original table number from the main report and to supply the appropriate cost back-up data. The piled jacket concept is described in Section A.2, the hybrid platform in Section A.3 and the concrete gravity platform in Section A.4. Finally floating systems are described in Section A.5.

The costs were prepared by BWA in conjunction with M & R who produced cost estimates for the majority of the steel piled jacket and steel portion of the hybrid concept. M & R also supplied input into costs for the yard assembly of the deck facilities.

A.2.0 PILED JACKET CONCEPTS

A2.1 300 ft, 100,000 bopd, Japan

		($MM)	
1.	Engineering, Management (10%)		
	Marine Insurance		23.3
2.	Jacket:		
	Materials	5.9	
	Fabrication	13.7	
	Transportation	2.5	
	Installation	4.7	26.8
3.	Deck:		
	Materials	1.5	
	Fabrication	4.5	
	Transportation	0.6	
	Installation	0.3	6.9
4.	Piles:		
	Materials	8.0	
	Fabrication	2.7	
	Transportation	2.0	
	Installation	20.3	33.0
5.	Facilities:		
	Steel and Fabrication	8.4	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Accommodation Module	24.0	
	Yard Assembly	30.8	
	Transport	5.2	
	Installation	1.1	
	Offshore	8.5	166.0
6.	Total		256.0

TABLE 5.3.1 ESTIMATED COST, PILED STEEL JACKET, 300 FT WATER DEPTH, JAPAN, 100,000 BOPD PRODUCTION

Sept 5 - Concept I - 300' W.D. - Steel Jacket - 8-60'ϕ Main
16-84'ϕ Skirts

Recap: Japan

Jacket:		
Mat'ls	5.88	
Fabrication	13.72	
Transport	2.49	
Install	4.73	
		26.82
Deck		
Mat'l	1.50	
Fabrication	4.50	
Transport	0.61	
Install	0.29	6.90
Piles / SKIRTS / Conductors.		
Mat'l	7.98	
Fabrication	2.66	
Transport	1.99	
Install	20.27	32.90
Modules:		
Transport	5.22	
Install	$1.14	6.36
		72.98

A.2.3

	Mob.	Seashell	Divers	Ground	Hammer	Sub Total	Tools	Mat'l	Fab	Total
						Breakdown				
Jacket	0.61	2.13	0.83	0.86		4.73	2.49	5.88	13.72	26.82
Deck		0.29				0.29	0.61	1.50	4.50	6.90
Pile	2.45	11.83	3.31		3.08	20.27	1.99	PS: 5.91 C: 2.07 7.98	P: 1.97 F: 0.69 2.66	32.90
Modules		1.14				1.14	5.22	—	—	6.36
Total	3.06	15.29	4.14	0.86	3.08	26.93	10.31	15.36	20.88	72.98

(A 2.9)

Sept. 5-

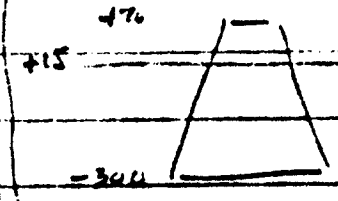
300' W.D. STEEL JACKET - 8 main 60"ϕ
16 skirts 84"ϕ.

FAB/TOWED - JAPAN to W.C.

FABRICATION:

Jacket wt. to +70 Main Frame 14100^K

Prorate:



$\frac{315}{370} \times 14{,}100^K = 12004^K =$

Total wt. = 21,300
- 14,100
+ 12,000
19,200/2 = 9,600^T

Jacket + Misc. to +70 = 21,300/2 = 10,650 - 85 (+70/+15) = 9800^T -
Piles - 8-60ϕ Main, 16-84ϕ skirts. - 9850^T
Conductors - 60 3450^T
Support Frame 2500^T
25,600^T

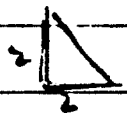
→ Fab: Japan

	U.P. Mat'l	Mat'l	U.P. Labor	Labor	Total U.P.	Total
Jacket	600	5.88	1400	13.72	2000	19.60
Piles/Skirts	600	5.91	200	1.97	800	7.88
Conductors	600	2.07	200	0.69	800	2.76
Supp Frame	600	1.50	1800	4.50	2400	6.00
Totals	600	$15.36 MM	816	$20.88 MM	1616	$36.24 MM

(A 2.8)

M.H's per weld:

2"



Area = $\frac{1}{2} \times 2 \times 2 = 2$ sq. in

Circumference = $60 \times 3.14 = 188.4$

Vol = $188.4 \times 2 = 376.8$ cu. in.

$wt = \frac{376.8}{1728} \times 480\#/cf = 105\#$

at 2#/hr = 52.5 M.H. 55

2½" – 82.5 MH 90

3" 120 120

As above:

1 @ 2½" @ 52.5 = 82.5

1 @ 3" @ 120 = 120.00

5 @ 2" @ 52.5 = 262.5

465

5 @ 412 5 @ 90 = 450

2 = 240 2 @ 120 = 240

652 690

[vs. 690 in original

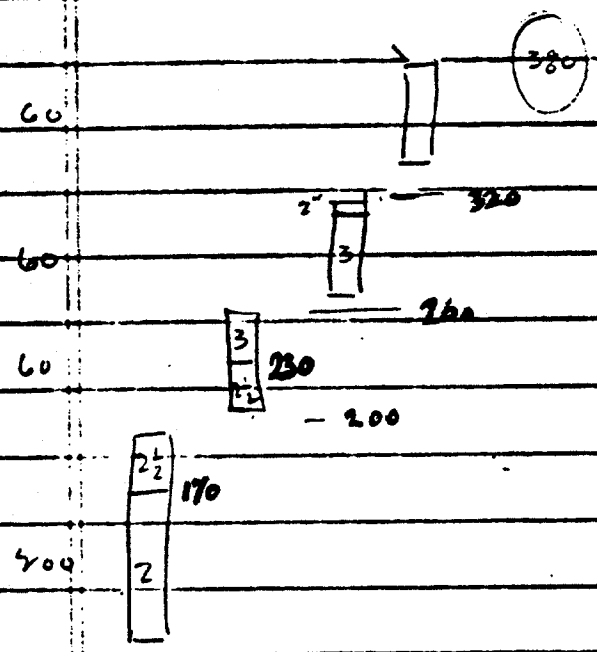
~~500~~ 465/5×24 = 4 days

Pure Welding Time

(A 2.9)

400
180
380

Skirt Pile:



1 @ 3" :
1 @ 2½" :
1 @ 2" :

	Area:	84'φ Circ.	Vol. cu. in	Wt. 480#/cf / 1728 cu in/cf	Time M.H's.	Use
2"	2	264	528	147	73.5	75
2½"	3.15	264	826	230	115	120
3"	4.50	264	1188	330	165	170

385 M.H.

$$\frac{385 \text{ M.H.}}{5} \times \frac{1}{24} = 2.67 \text{ days}$$

Main Pile Installation:

Using 5 welders/pile:

Welding Time: 4 days
Drive Time ½ ✓
Hammer on/off - 4E6 = 1 day
Stab Pile/6 add ons = 1 day
Two at time: = 1½ day

8 days / 2 pile = 4 days/pile.

Time for 8 pile = 32 days.

Skirt Pile Installation:

Weld Time - 3 days
Drive Time ½ day
Stab Time - ½ day - Assume 1st Section in Jacket?
Rig/DeRig Hammer ½ day

4½ day for a single pile

Add for two at time } 1½

6 days/2 = 3 days/pile

Total: 16 skirts @ 3 = 48 days

48
32
80 days.

Total Welding Time — Mains 4 × 4 = 16 — 2 × 8 = 16
Skirts 3 × 8 = 24 — 1½ × 16 = 24

40 days. ◁

Tows:

Jacket:

	Barge	Tug A	Tug B
* Mob Launch Barge to Japan -	27	27	0
Stand By for Load Out	7	7	0
* Tow to Site	26	26	26
Clear Customs	1	1	1
Stand by during launch	3	3	3
* De Mob from site: Barge & 1 Tug to W.C. 2nd Tug to Japan	12	12	20
20% Weather Factor *	14	14	10
Totals	90	90	60

Tow Japan to Bristol Bay w/ Jacket will require 2 tugs, assume 2nd tug available in Japan and will return light to Japan.

Launch Barge mob. from W.C. and returned to W.C.

Mobilization Times:	Distance Nautical Miles	Speed K	Days.
W.C. to Japan	5185	8 (Light)	27
Japan to Alaska - Loaded	3740	6	26
Alaska to W.C. - Light	2264	8 (Light)	12

Spread: Launch Barge 400 x 100 - 20^K/day

7000 H.P. Tugs - 4.6^K/day

Barge $90 \times 20^K =$ 1.80^{MM}

Tugs $150 \times 4.6^K =$ .69

Jacket Tow → $2.49^{MM}

A 2.10

Deck 1 - 300 x 90 Barge - Assume available in Japan and return to Japan.

Spread 300x90 Launch Barge - 4.7^K

7000 H.P. Tug. 4.6^K

	Barge	Tug	Tug	
Mob to Fab Yard	1	1		
Stand by for Load Out	7	2		
* Tow (Japan to Alaska)	26	26	2	Speed 6K/hr.
Clear Customs	1	1		
Stand by @ Location	3	3		
* Return to Japan	20	20		
Weather * 20% -	10	10		
Totals	67	62	2	

Barge 67 x 4.7K = $0.32 MM

Tugs 64 x 4.6K = 0.29

Deck Tow - $0.61 MM

Piling: 1 Barge 300x90 for 84φ skirts - 16x410 = 6,560

1st Layer - 260 x (11) = 2860 lf.

2nd " - 260 x 10 = 2600 lf.

3rd Lay - 260 x 9 = 2340 lf

7800 lf.

Three layers of 84"φ - stand appox 20' high.

1 Barge 300x90 for 60φ Mains - 8x620 = 4960'

1st Layer - 260 x (18) = 4680

Conductors - 60 @ 510 = (30,600') →

1st Layer 32 @ 260 = 8,320

31 @ 260 = 8,060

30 @ 260 = 7,800

24,180 → {remainder on deck barge!}

(A2.14)

Piling (Cont).

all barges & tugs from Japan —

Main Pile	Barge	Tug	Tug	
Mob to Fab Yard	1	1		
Stand by for L.O.	7	2		
* Tow	26	26	2	6K/HR.
Clear Customs	1	1		
Stand by Location	42	42		
* Return to Japan	20	20		
Weather 20% of *	10	10		
Totals.	107	102	2	

Skirt Pile.	Barge	Tug	Tug	
Mob to Fab Yard	1	1		
Stand by for L.O.	7	2		
* Tow	26	26	2	
Clear Customs	1	1		
Stand by Location	63	63		
* Return to Japan	20	20		
Weather 20% of Stn(*)	10	10		
Total	128	123	2	

Cost: Barge: 107 days + 128 days = 235 @ 4.7K = $1.10 MM

Tugs: 104 ✓ + 125 ✓ = 229 @ 3.9K = 0.89 MM

$1.99 MM.

Module Tow: 24 Packages

3 Levels - 200 × 250 =	150,000 sf.
1 Level - 100 × 250 =	25,000 sf.
Total	175,000 sf.

300 × 90 Cargo Barge: Effective Area = 260 × 80 = 20,000 sf.

Therefore $\frac{175,000}{20,000}$ = 9 Barge Loads.

Assume all available in Japan, Return to Japan:

Tandem Tow – 2 Barges / 1 Tug!

	Barge	Barge	Tug	
Mob to Fab Yard	1	1		
Stand by for Load Out	7	2		
Make up Tow	26	26	2	6K
* Tow				
Clear Customs	1	1		
Stand by @ Location	3	3		
* Return to Japan	(26)	(26)		6K
Weather 30% of (*)	16	16		
	81	76	3	

Allows more weather for tandem tow!

A2.16

Cost: Barge 81 days x 2 x 4.7[K] = $0.76 MM
Tug: 79 days x 4.6[K] = $0.36 MM
$1.12 MM

Single Tow: Barge: 75 day x 4.7 = $0.38 MM
Tug: 73 day @ 4.6 = $0.36 MM
$0.74 MM

4 @ 1.12 = $4.48 MM
1 @ 0.74 = 0.74
$5.22 MM

A 2.17

DIVERS: REQUIRED DURING LAUNCH / DRIVING SKIRTS GROUT.

Take chambers on board D.B. - assume eqpt paid only when in use!

Mob - 28 days

Work - launch 3.9

Decompress 3

Skirts - 62.4

Grout - 18.1

Decomp - 3

De Mob - 28

Total 118.4 days.

Cost: Eight divers, tenders - Sat. gear 35^K/day

118.4 days @ 35^K = 4.14^{MM}

Apportion Jacket 20% - 0.83^{MM} ⊗

Pile 80% - 3.31^{MM}

A 2.18

Hammers: Use Steam for main pile
Hydraulic for skirts - w/ No followers.

Hydraulic -
Mob - 18 days.
Skirts - 48+
Weather - 15
DeMob - 18 days
99 days @ 27.5K/day = $ 2.72 MM

Steam - Mob - 18 days
Skirts - 32
Weather - 10
DeMob - 18
78 days @ 4.6K/day = $ 0.36 MM
$ 3.08 MM

A 2.19

Grout Spread

Rental 6 mos. @ 4K/mo. = $0.03 MM

Crew: Work - 14
Mob - 7
DeMob - 7
Weather - 5

33 days @ 4.8K/day = $0.16 MM

Mat'l -

84 ϕ x 3" annulus = 5.50 cf/ft.
16 pile x 90 ft/pile = 1440 7,912 cf

60" ϕ x 3 annulus = 3.92 cf/ft.
8 pile x 340 = 2720 lf 10,662 cf

18,574 cf

Use 20,000 sacks @ 35.00 = $0.70 MM

Total Grout = $0.86 MM.

(A 2.20)

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RESULTS: assembly

The following Methodology was used to cost the deck facilities for fixed structures. The procedure was developed in consultation with M&R

Step 1 Compute the total weight of the facilities

Gas Handling	3500 kips
Oil facilities	4500 kips
Water flood	1200 kips
Generators etc	4000 kips
Utilities	1000 kips
Misc	1500 kips
Total	15,700 kips

The production facility weight

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(A 2.21)

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for 50,000 bopd is computed above from Table 2.6.4 of the text. The corresponding value for the 100,000 bopd case from the same table is 20,500 kips.

The drilling facilities in both the 50,000 bpd and 100000 bpd cases are 5,000 kips excluding the weight of the rigs. In addition it was assumed that 3,000 tons of module steel was included for the 100,000 bopd case and 2,000 tons of module steel was included in the 50,000 bopd case.

Step 2 Develop the costing procedure. The following procedure was used to compute manpower requirements

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(A 2.22)

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		RESULTS:

Take 100% of the production equipment weight, minus the module steel and add 70% of the drilling equipment weight minus the module steel. This gives an effective tonnage of equipment. The estimated manpower requirement for yard assembly in the Gulf of Mexico is

Piping	100	mhrs / ton
Electrical	50	mhrs / ton
Misc	20	mhrs / ton
Instrumentation	20	mhrs / ton
Total	190	mhrs / ton.

For Japanese fabrication 0.9 of this amount was assumed and for West Coast 1.1 of the

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(A 2.23)

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amount was required. Hence the following weights and manhours were used.

(1) 50,000 bopd.

Weight = 7850 + (0.7 x 2500) − 2000 = 7,600 tons

In Japan use 171 mhrs/ton

In U.S. West Coast 209 mhrs/ton

(2) 100000 bopd.

Weight = 10,250 + (0.7 x 2500) − 3000 = 9000 tons

In Japan use 171 mhrs/ton

In the U.S use 209 mhrs/ton

The total manhours required

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A 2.24

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one

	50,000 kgd	100000 kgd
Japan	1,299,600	1,589,000
U.S.	1,588,400	1881,000

These are the required manhours for yard assembly of the modules excluding module steel fabrication. The following fully burdened rates were applied

Japan $20 / hours
U.S. West Coast $35 / hour

The total costs for yard assembly are then

	50,000 kgd	100000 kgd
Japan	$MM 26.0	$MM 30.8
U.S	$MM 55.6	$MM 65.8

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A 2.25

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RESULTS:

Step 3

The assumed costs for module steel and fabrication were as follows

50,000 bpd	2,000 tons
100000 bpd	3,000 tons

The total steel + fabrication rates were assumed as follows

Japan	$ 2800 / ton
U.S	$ 3000 / ton

Hence the appropriate costs are

	Japan	U.S
50,000 bpd	5,600,000	6,000000
100000 bpd	8,400,000	9,000000

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(A 2.26)

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Step 4 : The actual costs of the drilling and production facilities were estimated from our internal data base and by comparison with estimated costs produced by the National Petroleum Council (NPC) in a December 1981 report.

These costs are summarized as follows

	50000 bpd	100000 bpd
Drilling	20.0	34.0
Production	46.0	54.0

where all cost are $MM and consumables are excluded.

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(A 2.27)

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Step 5 : The costs for an accommodations module were estimated as follows

125 man module for 50,000 keyd

140 man module for 100000 keyd

The fabricated and installed costs were

	50,000	100000
Japan	18.0	24.0
U.S	20.0	27.0

where all costs are in $MM

FILING CODE:

(A.2.28)

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RESULTS:

Step 6

To compute the offshore hook-up and commissioning costs a simplified procedure was used. Typically for the fixed platforms the offshore component required is 4 to 5% of the on-shore assembly ~~cost~~ manhours. Because of the remote region we will ~~used~~ here 10% as an estimate. Hence we require here

50,000 bpd — 144,400 hours

100000 bpd — 171,000 hours.

The assumed cost was $50/hour

The total cost are

50,000 bpd	$MM 7.2
100000 bpd	$MM 8.5

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A2.27

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		RESULTS:

These numbers are approximate and in the report we used $8.5 MM for both cases as transportation and mobilization charges are likely to be similar and this is not reflected in a straight hour comparison.

FILING CODE:

A 2.2 300 ft, 100,000 bopd, U.S West Coast A 2.130

		($MM)	
1.	Engineering, Management (10%) Marine Insurance		27.5
2.	Jacket:		
	Materials	5.9	
	Fabrication	16.7	
	Transportation	1.3	
	Installation	4.7	28.6
3.	Deck:		
	Materials	1.5	
	Fabrication	5.3	
	Transportation	0.4	
	Installation	0.3	7.5
4.	Piles:		
	Materials	8.0	
	Fabrication	5.3	
	Transportation	1.7	
	Installation	20.3	35.3
5.	Facilities:		
	Steel and Fabrication	9.0	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Accommodation Module	27.0	
	Yard Assembly	65.8	
	Transport	3.7	
	Installation	1.1	
	Offshore Hookup/Commissioning	8.5	203.1
6.	Total		302.0

TABLE 5.3.2 ESTIMATED COST, PILED STEEL JACKET, 300 FT WATER DEPTH, U.S. WEST COAST, 100,000 BOPD PRODUCTION

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CALCULATION FOR: A 2.31

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RESULTS:

Compare this concept directly with section A 2.1

Item 2. Jacket material costs are the same. Fabrication based $ 1700 per ton U.S, 1400 per ton Japan. Installation is the same.

Item 3. Materials are the same, deck fabrication labour is $1800/ton Japan, $ 2100/ton U.S. Installation is the same

Item 4: Material is the same, fabrication labour assumed $ 200/ton Japan, $ 400/ton U.S. Installation the same.

Item 5: all the same except steel + fabrication representing different labour costs and likewise for the accommodation module (assumed 15% cheaper in Japan).
Remaining items are costed.

FILING CODE:

A 2.32

Dept. 6 - Concept I - 300' WD Steel Jacket
8-60φ Mains, 16-84φ skirts.
Fabrication on W.C. →

Installation Times the same.
D.B. Mobilization - Same.
Tows - decrease
Fabrication - increases.

Tows: Jacket: Assume barge on W.C., return to W.C.

	Barge	Tug	Tug	
Mob to Fab Yard	2	2	0	
Stand by for Load Out	7	2	0	
* Tow to site $\frac{2264}{6 \times 24}$	16	16	16	6 knots
Stand by during Launch	3	3	3	
* De Mob	12	12	10	8 knots
20% Weather	8	8	5	
	48	43	34	

Cost: Barge 48 @ 20ᵏ = $0.96 MM
Tug 77 @ 4.6ᵏ = 0.35 MM
$1.31 MM

A.2.35

Deck:

	Barge	Tug	Tug
Mob to Fab Yard	2	2	
Stand by for Load Out	7	2	
Tow	16	16	1
Stand by Location	3	3	
Return to W.C.	14	14	
Weather 20%(*)	6	6	
	48	43	1

Cost: Barge - 48 @ 4.7 = 0.23
44 @ 4.6 = 0.20
> $.43 MM

(A 2.34)

Piling:

Main Pile -

Tow	<10>	<10>
Clear.	<1>	<1>
Return	<6>	<6>
Weather	<3>	<3>
	<20>	<20>

Savings See I-Japan

Skirt Pile -

Tow	<10>	<10>
Clear	<1>	<1>
	<6>	<6>
	<3>	<3>
	<20>	<20>

Total Savings = 40 Barge Days @ 4.7 = $0.188 MM
40 Tug Days @ 3.9 = 0.156 MM
Savings
= 0.344 M -

Cost = 1.99 - 0.34 = $1.65 MM

(A2.35)

Module Tows:

Savings:

Tow	<10.>	<10>
Clear	<1>	<1>
Return	<10>	<10>
Weather	<3>	<3>
	<24>	<24>

Barge: 24×2 = 48× 4.7 = $0.23

Tug: 24 = 24× 4.6 = 0.11

Total Savings $0.34

For 4 tandem Tows = $1.36 MM

Single Tow - Savings = $.19 MM

Total Savings = $1.55 MM

Cost = 5.22 - 1.55 = $3.67 MM

(A 2.36)

Savings on all tows:

Deck 0.18

Pile - 0.34

Modules - 1.55

Jacket - 1.18

Total Savings = $3.25 MM

Total Fab Price in Japan = 20.68

3.26 = 15.6%

∴ W.C. Fab could be 15.6% higher

42.37

FABRICATION.

	WT.	Unit Mat'l	Mat'l	Unit Labor	Labor	Unit Total	Total
Jacket	9800	600	5.88	1700	16.66	2300	22.54
Deck	2500	600	1.50	2100	5.25	2700	6.75
Pile Skirts	9850	600	5.91	400	3.94	1000	9.85
Cond.	3450	600	2.07	400	1.38	1000	3.45
Total	25600	AVG. 600	15.36	AVG. 1064	27.23	1664	42.59

248
DIFF

BREAKDOWN.

	Install	Tow	Mat'l	Fab	Total
Jacket	4.73	1.31	5.88	16.66	28.58
Deck	0.29	0.43	1.50	5.25	7.47
Piles/skirts/cond.	20.27	1.65	7.98	5.32	35.22
Modules	1.14	3.67	—		4.81
Total	26.43	7.06	15.36	27.23	76.08

A 2.38

(A2.3)

A 2.3 Cost of a single jacket in a multiple jacket field development, 150 ft, 100000 bopd, Japan

			($MM)
1.	Engineering, Management		
	Marine Insurance (10%)		3.5
2.	Jacket:		
	Materials	2.2	
	Fabrication	5.1	
	Transportation	1.6	
	Installation	2.9	11.8
3.	Deck:		
	Materials	0.8	
	Fabrication	2.3	
	Transportation	0.6	
	Installation	0.3	4.0
4.	Piles:		
	Materials	2.7	
	Fabrication	0.9	
	Transportation	1.2	
	Installation	14.1	18.9
5.	Total		38.2

*No facilities costs included.

TABLE 5.3.5 ESTIMATED COST, MULTIPLE JACKET, 150 FT WATER DEPTH, JAPAN

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
		PAGE OF
SYSTEM:		ORIGINATOR: DATE:
CALCULATION FOR: A2.40		REVIEWER: DATE:
		REVISION:
		RESULTS:

Comments.

The procedure for costing the deck, jacket and modules is exactly as section A2.1 for Japan and A2.3 for West Coast. What is presented here is an application of the procedure to the case of a single jacket in a proposed multiple jacket development.

FILING CODE:

Modification of 300' W.D. to 150' W.D Structures.
Steel Jacket, 4 mani, 8 skirts - Steel Deck.

* Mobilization / DeMob - (D.B. Only)

Same $3,080,000

Materials Procurement:

Jacket	[Page 2]	2,190,000	
Deck Frame	✓	750,000	
Modules	-		
Equipment	-		
Piles	✓	2,115,000	
Conductors	✓	615,000	
			$5,670,000

Jacket:

Fabrication / L.O. -			5,110,000
Transport	[Page 2]		$1,590,000
InStall	[Page 6]		2,258,000
		Sub T. → 8,958,000	

A2.42

Piles:	Conductors [See Page 2]		205,000
	Fabrication/L.O. [Page 2]		~~820,000~~ 705,000
	Transport - [Page 3]	Subt → $13,833,000	$1,263,000
	Install - [Page 6]		11,660,000
Deck Support Frame			
	Fabrication/L.O. [See Page 2]		2,250,000
*	Transport [Page 2]	Subt. 3,145,000	$609,000
*	Install [Page 4]		286,000
Modules —			
	Transport [Page 3]		$1,120,000
	Install [Page 4]	Subt. - 2,536,000	286,000
	Offshore Hook up. [Page 3]		~~$30,000~~
See Page 7 -	Builders Risk 2% of Total Value —		37.02-93 = 360
* Unchanged from previous est.		Total —	$ 37,022,000

Fabrication Costs:

Jacket - Page 11 of BNA - 7300 K/2 = 3650

Pile & Skirts - 7050/2 = 3525 T

? → Deck Frame - 2500 T (Est.)/2 = 1250 T

Conductors - 2050/2 = 1025 T

Component	Unit Mat'l	Mat'l Cost	Unit Fab.	Fab Cost.	Total
Jacket	600	2,190,000	1400	5,110,000	7,300,000
Pile	600	2,115,000	200	705,000	2,820,000
Conductors	600	615,000	200	205,000	820,000
Deck Frame	600	~~1,500,000~~ 750,000	1800	~~4,500,000~~ 2,250,000	~~6,000,000~~ 3,000,000
		5,670,000		8,270,000	13,940,000

AVG: 1475

(A 2.44)

Transport:

Jacket - Times Identical as before

Use a smaller Barge - 300×90 - $10,000

1-6000 H.P. Tug 4,600

Barge - 90 × 10,000 = $ 900,000

150 × 4600 = 690,000

$1,590,000

Deck - Same as before - $ 609,000

Piles. 4 @ 400' + penetration 150' W.D. + 15 = 565' × 4 = 2260'

8 @ 400 + 85' + 10' = 495 × 8 = 3960

6220'

1 Barge will carry all pile/cond.

~~Same as 300' Structure~~

		Barge	Tug	Tug	
Time -	Mob to Fab	1	1		
	S.B. for L.O.	7	2		
	* Tow	26	26	2	
	Clear Customs	1	1		
	** Stand by Location	63	63		Total
	* Return to Japan	20	20		
	Weather 20% (*)	10	10		Con't on
	Weather 30% (**)	19	19		Page 5 (a

Pile Con't.

	Barge	Tug	Tug
Totals	147	147	2

Barge - 147 days @ 4700 = 690,900

Tug 149 days @ 3900 = 573,300

1,263,200

Modules. (Drill & Accomdation Only)

Assume 2 barge loads.

Double Tow - $1,120,000

Hookup: 25 men @ $35/hr x 24 x 30 = $630,000

Support $10,000 x 30 = 300,000

$930,000

Installation Time:

	Working	Working + 30% Weather
Launch Jacket, Set on location	3	3.9
Stab/Drive A1 - B2 (2 less splices)	~~+~~ 12	15.6 ~~+8.2~~
A2 - B1	~~+~~ 12	15.6 ~~+8.2~~
Stab/Drive Skirts (8) (Exactly ½ wk.)	26	33.8
Set, W.O. Deck Support Frame	2	2.6
Set Modules - 6 @ 8 hrs/ea.	2	2.6
Grout Skirts	6	7.8
Weather (30%)	19	0
	82	82

Best Installation Periods - June, July, August (90 days)

- 15 May - 15 Sept 120 days

Breakdown of Installation Times

Jacket & Grout	11.8 days	1,298,000
Pile & Skirts	65.0 days	7,150,000
Deck	2.6 days	286,000
Modules.	2.6 days.	286,000
	82 days @ $110,000 =	$9,020,000

(A2.47)

Divers.

Work - *Launch - 3
DeComp. - 3
*Skirts - 26
*Grout 6
DeComp. 3
30% of (*) = 11

52 days @ ~~35,000~~ =

Mob/DeMob 28 days.

80 days @ 35,000 = $2,800,000

ProRate - 20% Jacket = ~~2,240~~ 560,000
80% Pile/Skirts = 2,240,000
2,800,000

Hammers - 2@27,000/day -

Mob - 18
Work Skirts 26
30% Weather 8
DeMob - 18

70 days @ 27,500 = $1,890,000

Steam - Mob 18
Main Pile - 24
Weather - 7
De Mob - 18

67 days @ $4600/day = 380,000

~~2,270,000~~

$2,270,000

(A 2.48)

Grout:

Rent 3 mos @ 4,000 =	12,000
Crew: 8 days @ 4,800 =	38,400
	$ 50,000

Mat'l - 10,000 sacks @ 55.00 =	$ 350,000
	$ 400,000

(x) Pile Installation

Pile Installation:

Install - See Page 4	7,150,000
Hammers - See Page 5	2,270,000
Divers - See Page 5	2,240,000
To page ① →	$ 11,660,000

Jacket Installation:

Installation - See Page 4	1,298,000
Divers - See Page 5	560,000
Grout - Page 6	400,000
To Page ① →	$ 2,258,000

Comments –

Installation time for a single platform with 30% weather is 82 days well within the best weather window from 15 May to 15 Sept. [Actually between the best window of 1 June to 31 August].

Although there would be some differences in each structure, you can only be assured of installation of one platform per year – trying to do two in one year may be very risky. The installed cost of 4 such structures done on 4 mobilizations would be approximately $150 million. The initial drill structure of $37 million would indicate whether the remainder of the $150 million should be spent.

(A2.50)

A 2.4 Cost of a single jacket in a multiple jacket field development, $50 ft, 100000 bopd, West Coast.

		($MM)
1. Engineering, Management		
Marine Insurance (10%)		3.6
2. Jacket:		
Materials	2.2	
Fabrication	6.2	
Transportation	0.8	
Installation	2.9	12.1
3. Deck:		
Materials	0.8	
Fabrication	2.6	
Transportation	0.4	
Installation	0.3	4.1
4. Piles:		
Materials	2.7	
Fabrication	1.8	
Transportation	1.1	
Installation	14.1	19.7
5. Total		39.5

* No facilities costs included.

TABLE 5.3.6 ESTIMATED COSTS MULTIPLE JACKET, 150 FT WATER DEPTH, U.S. WEST COAST

BRIAN WATT ASSOCIATES, INC.
CONSULTING ENGINEERS
HOUSTON, TEXAS

CLIENT:

PROJECT:

FILING CODE:

JOB NO.

PAGE OF

ORIGINATOR:

DATE:

REVIEWER:

DATE:

REVISION:

SYSTEM:

CALCULATION FOR: A2.5I

RESULTS:

Comments

The procedure followed here is exactly as per section A2.3 using West Coast prices.

FILING CODE:

Concept I-A - Four Separate Structures: (A2.52)
W.C. Fabrication

Jacket:		
Mat'l	$2.119	
Fabn.	$6.21	
Trans.	$0.82	
Install	$2.88	12.10
Deck		
Mat'l	0.75	
Fabn.	2.63	
Trans.	0.43	
Install	0.29	4.10
Pile, Skirts		
Mat'l	2.73	
Fabn	1.82	
Trans.	1.08	
Install	14.12	19.75
Modules		
Mat'l		
Fabr.		
Trans.	0.94	
Install.	0.29	1.23
		37.18

A-2.53

FABRICATION:

	Wt.	Unit Matl	Matl	Unit Labor	Mans.	Unit Total	Total
Jacket	3650	600	2.19	1700	6.21	2300	8.40
Deck	1250	600	.75	2100	2.63	2700	3.38
Piles, Skirt, Cond.	4,550	600	2.73	400	1.82	1000	4.55
	9,450	600	5.67	1128	10.66	1728	16.33

Tows:		Japan	Towing	Cost.
(A)	Jacket	1.59	0.77	0.82
(B)	Deck	0.61	0.18	0.43
(C)	Pile	1.26	0.18	1.08
(D)	Modules.	1.12	0.18	0.94
		4.58	1.31	3.27

(A 2.54)

(A) - Savings - Mob - ⟨25⟩ ⟨25⟩ Mob
⟨10⟩ ⟨10⟩ ⟨10⟩ Tow
⟨4⟩ ⟨1⟩ ⟨1⟩ clear.
⟨12⟩ DeMob
⟨7⟩ ⟨7⟩ ⟨7⟩
⟨43⟩ ⟨43⟩ ⟨30⟩

43 Barge Days @ 10K = $0.43
73 Tug Days @ 46K = 0.34
0.77

(B) Save 20 days barge and tug.

Breakdown

	Installation	Tow	Mat'l	Fab.	Total
Jacket	2.88	0.82	2.19	6.21	12.10
Deck	0.29	0.43	.75	2.63	4.10
Piles	~~14.12~~ ~~11.66~~	1.08	2.73	1.82	~~19.75~~ ~~17.29~~
Modules	0.29	0.94	–	–	1.23
	17.58	3.27	5.67	10.66	37.18

36.10
1.08
37.18

(A 2.55)

(A 2.56)

A 2.5 Single jacket, all facilities, 100000 bopd, Japan, 150 ft.

		($MM)	
1.	Engineering, Management Marine Insurance (10%)		22.4
2.	Jacket:		
	Materials	4.6	
	Fabrication	10.8	
	Transportation	2.5	
	Installation	4.2	22.1
3.	Deck:		
	Materials	1.5	
	Fabrication	4.6	
	Transportation	0.6	
	Installation	0.3	7.0
4.	Piles:		
	Materials	6.7	
	Fabrication	2.2	
	Transportation	1.9	
	Installation	17.7	28.5
5.	Facilities:		
	Steel and Fabrication	8.4	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Accommodation Module	24.0	
	Yard Assembly	30.8	
	Transport	5.2	
	Installation	1.1	
	Offshore Hookup	8.5	166.0
6.	Total		246.0

TABLE 5.3.3 ESTIMATED COST, PILED STEEL JACKET, 150 FT WATER DEPTH, JAPAN, 100,000 BOPD PRODUCTION

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
		PAGE OF
SYSTEM: (A 2.57)		ORIGINATOR: DATE:
CALCULATION FOR:		REVIEWER: DATE:
		REVISION:
		RESULTS:

Comments.

Item 2, material costs and fabrication labor costs have unit rates as per section A2.1. Transportation / installation costs derived here.

Item 3 exactly as per item 2

Item 4 as per item 2

Item 5 all facilities costs are exactly as per Item 5 on page A2.2, section A2.1

FILING CODE:

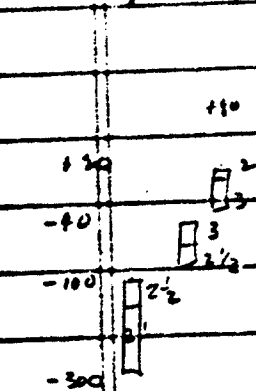
BREAK DOWN:

	Mob.	Install	Divers	Hammer	Grout	Sub Total	Tow	Mat'l	Fab.	Total
Jacket	0.61	2.43	0.47		0.68	4.19	2.49	4.60	10.75	22.03
Deck		0.29				0.29	0.61	1.54	4.63	7.07
Skirts/Pile/Cond	2.45	10.33	1.89	3.04		17.71	1.90	PS = 5.46 C = 1.23 6.69	P = 1.82 C = 0.41 2.23	28.53
Modules		1.14				1.14	5.22	–	–	6.36
Total	3.06	14.19	2.36	3.04	0.68	23.33	10.22	12.83	17.61	63.99

42.58

42.59

Main Pile Make Up.



Four Splices

2@2" @ 55 = 110

1@2½@85 85

1@3@120 120

260 M.H.

Welding Time - 2½ days.

Drive Time ½ ✓

Stab Time - ½ ✓

Rig / de Rig Hammer 1

per 4½ days

for first at a time 1½ day

6 x 6 = 27 days.

Skirt, same as 300' W.D.

INSTALLATION: 129 days @ 110K = $14.19 MM USD.

Jacket	3/14 } 17	2.43
Skirts/Piles	24/48 } 72	10.33
Support Frames	2	0.29
Modules.	8	1.14
		14.19

A2.60

FABRICATION: (JAPAN)

	Wt.	Unit Mat'l	Mat'l	Unit Labor	Labor	Total Unit	Total
Jacket	7680	600	4.60	1400	10.75	2000	15.35
Deck	2570	600	1.54	1800	4.63	2400	6.17
Main/skirts	9100	600	5.46	200	1.82	800	7.28
Cond.	2050	600	1.23	200	0.41	800	1.64
		600	12.83	823	17.61	1423	30.44

42.61

* Deck wt = 1650^{T} + 920^{T} = 2570 T

Jacket wt. = $\frac{17,200 - 920}{2}$ = 7680 T

Tows: Jacket - Same as I = 2.49 M

Deck - Same as I = 0.61 M

Pile - 1 Barge for 84" ϕ skirts } Same as I
1 Barge for remainder }

except - Save 8 x 1.3 = 10 days. on piles

Savings: 1 tugs } 10 days @ 3.9 / 4.7
2 Barg }

8.6 x 10 = 86 K

∴ 1.99 - 0.09 = 1.90

Module Tows. Same = 5.22

1 Divers: Drop spread from full sat to Helium Bounce

Diving @ 20 K

118 days @ 20 K = $ 2.36

20% J = 0.47
80% P = 1.89

Hammers - Save - 10 @ 4.2 K/day = $0.04

3.08 - 0.04 = $ 3.04

A 2.62

Grout: Slants (same) 7,912 cf.

60"ϕ - c 3" ann. - 3.92 cf

8 pile @ 190 = 1520 lf. @ 3.92 = 5958

13,870 cf x 1.08 = 15,000 sa

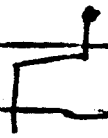
15,000 sacks @ 35#/sack = ϕ 0.52 MM

Spread - Same as I - 0.16 MM

Total = ϕ 0.68 MM

A263

Installation Times -	Work	Work + 30% Weather
Launch, Set Jacket -	3 days	3.9
Drive 8 main Pile -	24 days	31.6
Drive 16 Skirt Pile -	48 days.	62.4
Set Deck Support Frame -	2	2.6
Grout Joints	14	18.1
Set Modules	8	10.4
	99	
30% Weather	30	0
	129	129



A 2.6 Single jacket, all facilities, 100000 bopd, West Coast, 150 ft (A2.6)

		($MM)	
1.	Engineering, Management Marine Insurance (10%)		26.5
2.	Jacket:		
	Materials	4.6	
	Fabrication	13.1	
	Transportation	1.3	
	Installation	4.2	23.2
3.	Deck:		
	Materials	1.5	
	Fabrication	5.4	
	Transportation	0.4	
	Installation	0.3	7.6
4.	Piles:		
	Materials	6.7	
	Fabrication	4.7	
	Transportation	1.6	
	Installation	17.7	30.7
5.	Facilities:		
	Steel and Fabrication	9.0	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Accommodation Module	27.0	
	Yard Assembly	65.8	
	Transport	3.7	
	Installation	1.1	
	Offshore Hookup/Commissioning	8.5	203.1
6.	Total		291.1

TABLE 5.3.4 ESTIMATED COST, PILED STEEL JACKET, 150 FT WATER DEPTH, U.S. WEST COAST, 100,000 BOPD PRODUCTION

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
		PAGE OF
SYSTEM:	A 2.65	ORIGINATOR: DATE:
CALCULATION FOR:		REVIEWER: DATE:
		REVISION:
		RESULTS:

Comments.

Refer to sections A 2.2 and A 2.5 for all facility and material unit rate costs.

FILING CODE:

A2.66

FABRICATION:

	WT.	Unit Mat'l	Mat'l	Unit Labor	Labor	Unit Total	Total
Jacket	7680	600	4.60	1700	13.06	2300	17.66
Deck	2570	600	1.54	2100	5.40	4700	6.94
Pile, Skirts, Cond.	11,150	600	6.69	400	4.46	1000	11.15
Total	21,400	600	12.83	1071	22.92	1671	35.75

	Japan	Savings	Cost
Tows: Jacket	2.49	1.18	1.31
Deck	0.61	.18	.43
Pile	1.99	.34	1.65
Modules	5.22	1.55	3.67
	10.31	3.25	7.06

Breakdown:

	Mob, Install, Piles, Grout, Hammers	Tow	Mat'l	FAB	Total
Jacket	4.19	1.31	4.60	13.06	23.16
Deck	0.29	043	1.54	5.40	7.66
Pile Skirts Cond.	17.71	1.65	6.69	4.46	30.51
Modules	1.14	3.67	-	-	4.81
Total	23.33	7.06	12.83	22.92	66.14

(A3.1)

A.3.0 HYBRID PLATFORM

A 3.2

A 3.1 Hybrid platform, 100000 bopd, 300 ft, Japan.

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		37.7
2.	Steel Jacket		
	Materials	7.7	
	Fabrication	13.7	
	Tow to Mating Site	0.3	21.7
3.	Deck		
	Materials	1.5	
	Fabrication	4.5	
	Tow to Mating Site	0.3	6.3
4.	Concrete Structure		
	Construction Site (4 Uses)	3.3	
	Skirts	0.6	
	Base Slab	12.6	
	Walls	63.8	
	Tow to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	6.5	
	Hull Systems	27.0	
	Tow to Mating Site	0.3	118.1
5.	Modules		
	Steel and Fabrication	8.4	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	24.0	
	Yard Assembly	30.8	
	Tow to Mating Site	1.3	152.5

TABLE 6.3.3 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 300 FT WATER DEPTH, 100,000 BOPD (SHEET 1 OF 2)

		($MM)	
6.	Mating: Inshore Location		
	Concrete Base to Jack.	1.7	
	Install Modules	0.8	
	Hookup	5.1	7.6
7.	Tow to Alaska		
	Prepare for Tow	1.0	
	Barite Ballast:		
	Eqpt.	2.8	
	Mat'l.	11.6	
	Tow	11.0	26.4
8.	Install & Commission		
	Water Ballast	3.2	
	Grout Under Base:		
	Mat'l	6.0	
	Eqpt.	3.8	
	Barite Ballast:		
	Mat'l	15.4	
	Eqpt.	7.0	
	Diving Support	6.7	
	Commission	1.0	
	Demob Equipment	1.3	44.4
9.	Total		414.7

TABLE 6.3.3 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 300 FT WATER DEPTH, 100,000 BOPD (SHEET 2 OF 2)

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
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Comments

(1) All steel unit rates are as for the piled jacket concept.

(2) For item 2 deck costs, see the appropriate fabrication labor and material costs page A 2.2, Section A 2.1

(3) For all topside facility costs, item 5 see page A 2.2, Section A 2.1

(4) For concrete base costs refer to section A 4.1 summary sheet (concrete gravity platforms)

(5) All costs associated with temporary buoyancy tanks have been removed from the final cost estimate.

(6) The bauxite costs developed here are used in a prorated fashion in all gravity concepts Sections A3, A4.

FILING CODE:

(A 3.5)

300' W.D. - Hybrid -

Steel Fabrication:

	Wt. Tons	Unit Mat'l	Mat'l	Unit Labor	Labor	Unit Total	Total
Jacket	9,300	600	5.58	1400	13.02	2000	18.60
Deck	2500	600	1.50	1800	4.50	2400	6.00
Conductors	3450	600	2.07	200	.69	800	2.76
	15,250	600	9.15	1194	18.21	1794	27.36

W/o Deck - Jacket Cond. Only	7.65	13.71	21.36

Breakdown of Costs:

deleted

	Mob. Demob	Prep for Backst	Ballast	Remove Tanks	Grout	Bristle Pack	Weather	Eqpt.	Mat'l	Divers	Tot
Water Ballast	.20	1.53	.34				.14	1.00			3.21
Grout	.90				1.30		.61	1.00	6.0		9.81
deleted → Remove Tanks.	.20			.68			.14	-			1.02
Diver Support										6.66	6.6
Bristle Pack	1.76					4.00	1.20		15.42		22.3
	2.06	1.53	.34	.68	1.30	4.00	2.09	2.00	21.42	5.11	43.0

(A 3.6)

Hybrid Structure: 300' w/D.

Page 17 - BWA ltr. of Aug. 26, 1985:

	300'	150'
JACKET MAIN FRAME =	14,600^K	9500^K
CONDUCTOR Framing, cages, [illegible] =	4,000^K	3500^K
Total Jacket =	18,600^K	13,000^K
	9,300^T	6500^T
Support Frame (From ltr. as above)	2500^T	2500^T
Conductors (Assumed)	3450^T	2100^T

(A 3.7)

~~Page 6 of~~

~~Sch 1 & 2~~ Assembly Site

Tow to Assembly Site (BASE)

Mob 4 - 12000 H.P. Tugs - 1 day
Three Pulling - 1 chase

(A) 4 @ 10,000 — 40,000

Tow to Location	2 days	80,000
Set on Location	2 days	80,000
De Mob	1 day	40,000
		$ 240,000

Tow Steel to Assembly Site:

	Barge Days. Mob/DeMob	L.O.	Tow	S.B.	Total
Jacket - Fab in four pcs					
(B) 2 Barges	4	14	2	10	30
Deck Frame: 1 barge	2	7	1	2	12
Tanks : 1 barge	2	7	1	12	22
Barge Time	8	28	4	23	63

Mat'l Barges Only 63 days @ 5000.00 = $ 325,000
Tugs: 8 + 4 + 23 = 35 days @ 5,000.00/day = $ 175,000
$ 500,000

Apportion: $ 0.3 MM to Jacket
$ 0.2 MM to Deck, etc.

(A 3.8)

ERECT STEEL ON CONC. BASE:

(C) Jacket Sections:

4 pcs -

Set 2 @ a time & Weld out.

Set piece (I) -	1 day
Set piece (2) -	½ day
Weld out -	5 days.
~~Weld out~~	~~5 days.~~
Set Pc. III	1 day
Set Pc IV	½ day
Weld Out	5
Misc.	½ day
	13½ days

Page 7 of

Schedule 2 - Cont.

Spread - 1 DB + Tug & labor - 80,000$
2 Standby Tugs 20,000$
~~1 DB + tug~~. 13½ days @ 100,000 = $1,350,000

(D) Set Support Frame & Weld out:-

Set deck in two sections: 1 day.
Weld out - 2 days 2 days
Total = 3 days

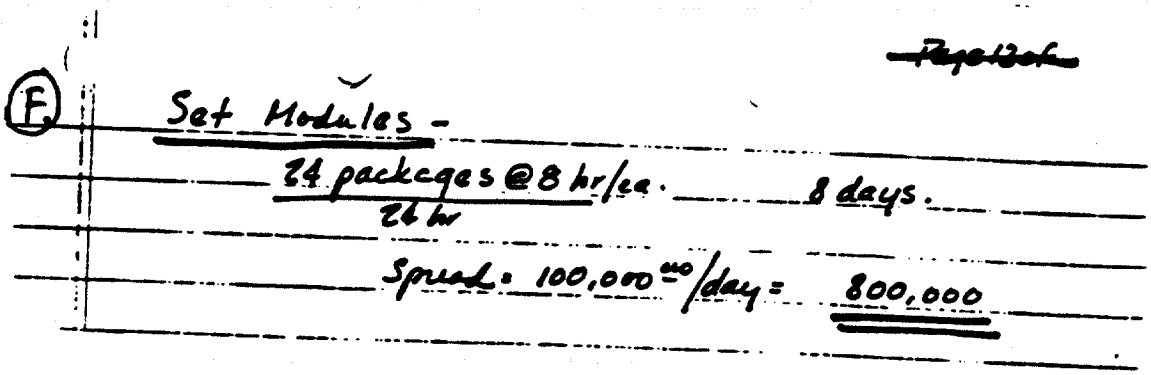
Spread as above = 3 @ 100,000 = $300,000

$1.65 MM

II - HYBRID JACKET COSTS - OPERATIONS AT MATING SITE. (Sh. 1.)

A 3.9

FILING CODE:



II - HYBRID JACKET COSTS - OPERATIONS AT MATING SITE. (Sh. 2).

(A 3.10)

Note these haute costs have been prorated based on weight / volume to all gravity systems.

Earth Required (from above Itr.)

386,000^K (15') Japan. = @ 0.03/# $11.58 MM

514,000^K (20') Site = 15.42 MM

$26.90 MM

Pump Times @ 100 cy/hr. x 20 hrs/day = 2000 yds = 54,000 cf.

Japan: $\frac{386,000^K}{.26} = 1,473,000$ cf @ 54,000/day = 27.5 days.

Site $\frac{514,000^K}{.26} = 1,962,000$ cf @ 54,000/day = 36.5 days

[100^K/day] EQUIPMENT COST = Jap. $2.75 MM

[110^K/day] - 36.5 x 1.30 = 47.5 days Site $5.20 MM

weather

7 days for preparation ...

52 days total tow time (see notes in Appendix):

Japan – Attu Island : 2200 NM @ 2.5 kts ⇒ 37 days

Attu Island – Location : 1100 NM @ 3.0 kts ⇒ 15 days

TOTAL = 52 days

7 + 52 = 59 ≈ 60 days

Need 2 - 22,000 HP tugs ($25 k/day)

3 - 11,000 HP tugs ($20k/day)

⇒ Cost tugs = 2 × $25 k/day × 60 days

+ 3 × $20k/day × 60 days = $6,600,000

To demobilize the tugs back to Japan ~ 14 days

2 × $25k × 14 + 3 × $20k × 14 = $1,580,000

$8.14 MM

- Bathymetric Survey allow $1.50 MM
- Misc. Bunkering, Towmaster, connections 1.35 MM

Total $10.99 MM

II - HYBRID JACKET COSTS - TOW TO LOCATION.

[redacted]

A 3.2 Hybrid Platform, ~~Japan~~ U.S., 100000 bopd, 300 ft.

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		43.9
2.	Steel Jacket		
	Materials	7.7	
	Fabrication	16.7	
	Tow to Mating Site	0.3	24.7
3.	Deck		
	Materials	1.5	
	Fabrication	5.3	
	Tow to Mating Site	0.3	7.1
4.	Concrete Structure		
	Construction Site (4 Uses)	3.3	
	Skirts	0.8	
	Base Slab	15.7	
	Walls	79.1	
	Tow to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	8.0	
	Hull Systems	27.0	
	Tow to Mating Site	0.3	138.2
5.	Modules		
	Steel and Fabrication	9.0	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	27.0	
	Yard Assembly	65.8	
	Tow to Mating Site	1.3	191.1

TABLE 6.3.5 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN WEST COAST, 300 FT WATER DEPTH, 100,000 BOPD (SHEET 1 OF 2)

(A 3.13)

		($MM)	
6.	Mating: Inshore Location		
	Concrete Base to Jack.	1.7	
	Install Modules	0.8	
	Hookup	6.9	9.4
7.	Tow to Alaska		
	Prepare for Tow	1.0	
	Barite Ballast:		
	Eqpt.	2.8	
	Mat'l.	11.6	
	Tow	9.0	24.4
8.	Install & Commission		
	Water Ballast	3.2	
	Grout Under Base:		
	Mat'l	6.0	
	Eqpt.	3.8	
	Barite Ballast:		
	Mat'l	15.4	
	Eqpt.	7.0	
	Diving Support	6.7	
	Commission	1.0	
	Demob Equipment	1.3	44.4
9.	Total		483.2

TABLE 6.3.5 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN WEST COAST, 300 FT WATER DEPTH, 100,000 BOPD (SHEET 2 OF 2)

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
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Comments

(1) Refer to Section A 3.1. Note Jacket costs etc for materials and labor use the material and labor costs in section A2.1 Tow is the same

(2) For the concrete base costs refer to section A4.2

(3) For the module costs, refer to sections A 2.2 for all costs except tow to mating site which is as in item 5, A3.1.

(4) Installation / commissioning costs as for Japanese case, A 3.1, tow costs slightly reduced from West Coast in item 7 as compared to Japan Slightly higher hookup costs (35%) used inshore, West Coast.

FILING CODE:

A3.3 Hybrid platform, 100000 BOPD, Japan, 150 ft. (A 3.15)

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		33.9
2.	Steel Jacket		
	Materials	5.2	
	Fabrication	9.5	
	Tow to Mating Site	0.3	15.0
3.	Deck		
	Materials	1.5	
	Fabrication	4.5	
	Tow to Mating Site	0.3	
4.	Concrete Structure		
	Construction Site (4 Uses)	3.3	
	Skirts	1.0	
	Base Slab	12.3	
	Walls	34.3	
	Tow to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	6.4	
	Hull Systems	25.0	
	Tow to Mating Site	0.3	86.6
5.	Modules		
	Steel and Fabrication	8.4	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	24.0	
	Yard Assembly	30.8	
	Tow to Mating Site	1.3	152.5

TABLE 6.3.2 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 150 FT WATER DEPTH, 100,000 BOPD (SHEET 1 OF 2)

(A 3.16)

		($MM)	
6.	Mating: Inshore Location		
	Concrete Base to Jack.	1.7	
	Install Modules	0.8	
	Hookup	5.1	7.6
7.	Tow to Alaska		
	Prepare for Tow	1.0	
	Barite Ballast:		
	Eqpt.	4.1	
	Mat'l.	17.2	
	Tow	11.0	33.3
8.	Install & Commission		
	Water Ballast	3.2	
	Grout Under Base:		
	Mat'l	6.6	
	Eqpt.	4.0	
	Barite Ballast:		
	Mat'l	12.6	
	Eqpt.	3.3	
	Diving Support	6.7	
	Commission	1.0	
	Demob Equipment	1.3	38.7
9.	Total		373.3

TABLE 6.3.2 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 150 FT WATER DEPTH, 100,000 BOPD (SHEET 2 OF 2)

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
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		DATE:
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		RESULTS:

Comments

(1) Concrete costs, refer to Section A 4.3 for corresponding concrete gravity platform.

(2) Modules are as for section A 2.1 in item 5

(3) For remaining costs refer to Section A 4.1. Grout and ballast costs prorated.

FILING CODE:

(A 3.18)

Hybrid - 150' W.D.

Fabrication:

	Wt.	Unit Mat'l	Mat'l	Unit Fab	Fab.	Unit Total	Total
Jacket	6500T	600	3.90	1400	9.10	2000	13.00
Deck	2500T	600	1.50	1800	4.50	2400	6.00
Cond.	2100	600	1.26	200	.42	800	1.68
			6.66		14.02		20.68

Barite Pumping →

Material

Japan: 572,000^{K} @ $.03/# = 17.16

Site: 420,000^{K} @ $.03/# = 12.60

29.76

Eqpt.

Japan: $\frac{572{,}000^{K}}{.262 \times 54{,}000}$ 41 days @ 100^{K} = $4.10^{MM}

Site: $\frac{420000^{K}}{.262 \times 54{,}000} \times 1.3 =$ 30 days @ 110^{K} = $3.30^{MM}

$7.40

A 3.4 Hybrid Platform, (H 3.1) 100,000 bopd, West Coast, 150 ft.

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		39.4
2.	Steel Jacket		
	Materials	5.2	
	Fabrication	11.6	
	Tow to Mating Site	0.3	17.1
3.	Deck		
	Materials	1.5	
	Fabrication	5.3	
	Tow to Mating Site	0.3	7.1
4.	Concrete Structure		
	Construction Site (4 Uses)	3.3	
	Skirts	1.3	
	Base Slab	15.3	
	Walls	42.5	
	Tow to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	7.9	
	Hull Systems	25.0	
	Tow to Mating Site	0.3	99.6
5.	Modules		
	Steel and Fabrication	9.0	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	27.0	
	Yard Assembly	65.8	
	Tow to Mating Site	1.3	191.1

TABLE 6.3.4 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN WEST COAST, 150 FT WATER DEPTH, 100,000 BOPD (SHEET 1 OF 2)

		($MM)	
6.	Mating: Inshore Location		
	Concrete Base to Jack.	1.1	
	Install Modules	0.8	
	Hookup	6.9	8.8
7.	Tow to Alaska		
	Prepare for Tow	1.0	
	Barite Ballast:		
	Eqpt.	4.1	
	Mat'l.	17.2	
	Tow	9.0	31.3
8.	Install & Commission		
	Water Ballast	3.2	
	Grout Under Base:		
	Mat'l	6.6	
	Eqpt.	4.0	
	Barite Ballast:		
	Mat'l	12.6	
	Eqpt.	3.3	
	Diving Support	6.7	
	Commission	1.0	
	Demob Equipment	1.3	38.7
9.	Total		433.1

TABLE 6.3.4 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN WEST COAST, 150 FT WATER DEPTH, 100,000 BOPD (SHEET 2 OF 2)

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
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		RESULTS:

Comments

(1) Items 2, 3 reflect increased fabrication labor costs, U.S. v Japan

(2) Item 4, see corresponding gravity system in Section A4.2, quantities prorated.

(3) Items 5, as per section A 3.2

(4) Items 6, 7, 8 as per previous sections.

FILING CODE:

A3.22

A3.5 Hybrid platform, Japan, 150 ft, 50,000 bopd.

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		26.2
2.	Steel Jacket		
	Materials	5.2	
	Fabrication	9.5	
	Tow to Mating Site	0.3	15.0
3.	Deck		
	Materials	1.5	
	Fabrication	4.5	
	Tow to Mating Site	0.3	6.3
4.	Concrete Structure		
	Construction Site (4 Uses)	3.3	
	Skirts	0.5	
	Base Slab	6.2	
	Walls	19.7	
	Tow to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	3.5	
	Hull Systems	25.0	
	Tow to Mating Site	0.3	62.5
5.	Modules		
	Steel and Fabrication	5.6	
	Drilling Facilities	20.0	
	Production Facilities	46.0	
	Quarters Facilities	18.0	
	Yard Assembly	26.0	
	Tow to Mating Site	1.3	116.9

TABLE 6.3.6 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 150 FT WATER DEPTH, 50,000 BOPD (SHEET 1 OF 2)

(A3.23)

		($MM)	
6.	Mating: Inshore Location		
	Concrete Base to Jack.	1.7	
	Install Modules	0.8	
	Hookup	4.6	7.1
7.	Tow to Alaska		
	Prepare for Tow	1.0	
	Barite Ballast:		
	Eqpt.	2.3	
	Mat'l.	9.7	
	Tow	11.0	23.0
8.	Install & Commission		
	Water Ballast	3.2	
	Grout Under Base:		
	Mat'l	3.8	
	Eqpt.	2.8	
	Barite Ballast:		
	Mat'l	8.9	
	Eqpt.	2.8	
	Diving Support	6.7	
	Commission	1.0	
	Demob Equipment	1.3	30.5
9.	Total		287.5

TABLE 6.3.6 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 150 FT WATER DEPTH, 50,000 BOPD (SHEET 2 OF 2)

BRIAN WATT ASSOCIATES, INC.
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A3.24

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DATE:

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RESULTS:

Comment.

(1) The major changes in this system are due to

a) Different concrete quantities in item 4. Same unit rates used as in Section A3.1

(b) Reduced facility costs in item 5. Same as for piled jacket case

(c) For remaining items cost are as per A3.1 with reductions for hookup and prorated grouting and ballast costs.

FILING CODE:

A 3.6 Hybrid platform, Japan, 300 ft, 50000 bopd. A 3.25

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		29.5
2.	Steel Jacket		
	Materials	7.7	
	Fabrication	13.7	
	Tow to Mating Site	0.3	21.7
3.	Deck		
	Materials	1.5	
	Fabrication	4.5	
	Tow to Mating Site	0.3	6.3
4.	Concrete Structure		
	Construction Site (4 Uses)	3.3	
	Skirts	0.5	
	Base Slab	9.1	
	Walls	42.3	
	Tow to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	4.7	
	Hull Systems	27.0	
	Tow to Mating Site	0.3	91.2
5.	Modules		
	Steel and Fabrication	5.6	
	Drilling Facilities	20.0	
	Production Facilities	46.0	
	Quarters Facilities	18.0	
	Yard Assembly	26.0	
	Tow to Mating Site	1.3	116.9

TABLE 6.3.7 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 300 FT WATER DEPTH, 50,000 BOPD (SHEET 1 OF 2)

		($MM)	
6.	Mating: Inshore Location		
	Concrete Base to Jack.	1.7	
	Install Modules	0.8	
	Hookup	5.1	7.6
7.	Tow to Alaska		
	Prepare for Tow	1.0	
	Barite Ballast:		
	Eqpt.	1.6	
	Mat'l. .	6.6	
	Tow	11.0	20.0
8.	Install & Commission		
	Water Ballast	3.2	
	Grout Under Base:		
	Mat'l	3.4	
	Eqpt.	2.2	
	Barite Ballast:		
	Mat'l	10.9	
	Eqpt.	2.7	
	Diving Support	6.7	
	Commission	1.0	
	Demob Equipment	1.3	31.4
9.	Total		324.8

TABLE 6.3.7 COST ESTIMATE FOR HYBRID STRUCTURE, FABRICATED IN JAPAN, 300 FT WATER DEPTH, 50,000 BOPD (SHEET 2 OF 2)

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
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Comments

Refer to sections A 3.1 — principal differences

(I) Modified concrete quantities due to lower storage requirements

(II) Reduce facility cost.

(III) prorated ballast / grout costs.

FILING CODE:

(A 4.0)

A.4.0 CONCRETE GRAVITY PLATFORM

A 4.1 Concrete unit rates

ITEM	UNIT	COST ($U.S.) U.S.	JAPAN
Concrete: Normal	cu.yd.	155	147
Lightweight		222	212
Reinforcement	s.ton	1,325	932
Post Tensioning	s.ton	4,540	3,820
Formwork	sq.ft.	5.34	4.66
Concrete Placing Rate	cu.yd./wk	2,000	3,450
Rebar Placing Rate	s.ton/wk	400	440
Post Tensioning Rate	s.ton/wk	50	55
Formwork Rate	sq.ft/wk	30,000	32,300

TABLE 6.3.1 UNIT RATES FOR REINFORCED CONCRETE IN JAPAN AND WEST COAST

UNIT COSTS - CONCRETE STRUCTURE

- CONCRETE PLACING : DIRECT EQUIPMENT COST
- CONCRETE MIXING
- PRE-STRESSING
- FORMWORK
- REINFORCING STEEL
- CONCRETE, CAST IN PLACE

} For each element

CONCRETE PLACING :

DIRECT EQUIPMENT COST

3 Tower Cranes @ $ 1,500,000 ea	$4,500,000
Buckets, Hoppers, etc	$ 1,000,000
	$ 5,500,000

Resale value = 50%

=> Cost	$ 2,750,000
Repairs & Maintenance (15%)	$ 412,500
Fuel & Power (450 days @ $ 216.90/day)	$ 97,600
	$ 3,260,100

=> Direct Equipment Cost = $\frac{\$\ 3,260,100}{125,500\ yd^3}$

$$= \$\ 25.98\ /yd^3$$

COST CONCRETE MIXING

Assume 2,000 yd^3/wk ; Total of ≈450 days.

Total concrete volume = 125,500 yd^3

- LABOR : 3 8-men shifts @ $20/hr accounting for overtime & productivity — $17.62/$yd^3$

- MATERIALS :
  Cement : 826 lb/yd^3 @ $0.029/lb
  Gravel : 1652 0.0032
  Sand 1155 0.0030
  Superplasticizer : 0.202 Gal/yd^3 @ $4.50/gal

  Account for Handling (10%) and Tax (5 2/5 %) — $38.95/$yd^3$

- EQUIPMENT, MAINTENANCE & POWER :
  2 Batching Plants @ $250,000 ea
  + Delivery ($10,000)
  + Aggregate Bin @ $100,000
  assuming 50% resale value ;
  Parts & Maint. @ $300/day ;
  Power @ $216.90/day
  Installation & Dismantle @ $200,000 — $5.95/$yd^3$

$62.52/$yd^3$

Accounting for Overhead & Profit @ 30% — $18.75/$yd^3$

TOTAL	$81.27/$yd^3$

Cost Pre-stressing Concrete

Crew	C-3
Man-hours	0.020
Unit	lb
Mat	0.83
Labor	0.49
Equip	0.03
Total	1.35
Total + Overhead & Profit	1.64
General Contractor's Overhead & Profit (30%)	0.49
	$2.13/lb

Seattle Cost Index = 106.7%

=> **$2.27/lb**

($4540.00/Ton)

SKIRTS

FORMWORK

Assuming Job built plyform wall forms, to 8 ft high, 4 uses:

Crew			C-2
Man-hours			0.095
Unit			S.F.C.A.
Material			0.46
Labor	$1.73 \times 1.311^{*}$	=	2.27
Equipment			0.05
Total			2.78
Total + Overhead & Profits			3.93

Increase by 20% to account for tapering 0.79

$4.72 / ft^2$

General Contractor's Overhead & Profit (30%) 1.41

$6.13 / ft^2$

Seattle City Cost Index = 106.5 %

=> **$6.53 / ft^2$**

---

* 1.311 = Factor to account for 3 shifts.

SKIRTS

REINFORCING STEEL

For walls, # 3 to # 7 bars:

Crew		4 Rodm
Man-hours		10.667
Unit		Ton
Material		495
Labor	215 × 1.311 =	282
Equipment		—
Total		777
Total + 0. & P.		952

Increase by 20% to account for tapering 190.40

$1142.40/Ton

General Contractor's O. & P. (30%) 342.72

$1485.12/Ton

Seattle Cost Index = 106.7%

⇒ **$1584.62/Ton**

SKIRTS

CAST IN PLACE CONCRETE

Concrete placed by crane and bucket.

Crew			C-7
Man-hours			0.674
Unit			yd^3
Material			—
Labor	10.75 × 1.311	=	14.09
Equipment			25.98
Total			40.07
Total + O. & P.			52.48
General Contractor's O. & P. (30%)			15.75
			$68.23 / yd^3

Seattle Cost Index = 111.1%

=> **$75.81 / yd^3**

SUMMARY UNIT COSTS

ELEMENT	FORMWORK ($/ft²)	REINF. STEEL ($/Ton)	CONCRETE MIXING ($/yd³)	CONCRETE CAST IN PLACE ($/yd³)	PRE-STRESSING ($/Ton)
Skirts	6.53	1584.62	81.27	75.81	4540.00
Base Slab	4.71	1330.23	↓	68.52	↓
Int. Walls	5.44	1320.52		75.81	
Ext. Walls	5.44	1320.52		75.81	
Top Slab	4.71	1330.23		68.52	

DETERMINATION OF AVERAGE UNIT RATES

CONCRETE:

- MIXING:

Skirts	61,301.96
Base Slab	1,445,228.47
Walls	6,922,566.41
Top Slab	706,979.92
	$ 9,136,076.76

$\Rightarrow$ $ 81.27 / yd^3

- CAST IN PLACE:

Skirts	57,183.48
Base Slab	1,218,494.59
Walls	6,457,484.43
Top Slab	596,065.76
	$ 8,329,228.26

$\Rightarrow$ $ 74.09 / yd^3

$\Rightarrow$ **TOTAL = $ 155.36 / yd^3**

AVERAGE UNIT RATES

REINFORCEMENT :

Skirts	332,916.62
Base Slab	6,588,695.70
Walls	31,329,112.51
Top Slab	3,223,067.48
	$ 41,473,792.31

=> **$ 1,324.58 / Ton**

POST-TENSIONING :

Skirts	238,454.87
Base Slab	5,621,708.80
Walls	26,927,693.40
Top Slab	2,750,059.60
	$ 35,537,916.67

=> **$ 4,540.00 / Ton**

AVERAGE UNIT RATES

FORMWORK :

Skirts	186,758.00
Base Slab	680,124.00
Walls	7,637,760.00
Top Slab	630,198.00
	$ 9,134,840.00

→ **$ 5.34 / ft²**

A 4.2 Concrete gravity platform, 100,000 bopd, Japan, 300 ft.

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		35.7
2.	Construction Site (4 Uses)		3.3
3.	Concrete Structure		
	Skirts	0.6	
	Base Slab	12.6	
	Walls	63.8	
	Transport to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	6.5	
	Towers	9.6	
	Hull Systems	27.0	
	Transport to Mating Site	0.7	124.8
4.	Topsides		
	Deck Fabrication	14.4	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	24.0	
	Yard Assembly	30.8	
	Transport and Mate	6.3	163.5
5.	Tow to Field (Incl. part barrite)		21.7
6.	Install & Commission		43.5
7.	Total		392.5

TABLE 7.4.2 COST ESTIMATE FOR CONCRETE GRAVITY PLATFORM, JAPAN, 100,000 BOPD, 300 FT WATER DEPTH

CONSTRUCTION SITE

ITEM	COST
SITE RENTAL	152,000
ACCESS ROADS	562,000
CLEARING & GRUBBING	38,000
EXCAV. & BACKFILL (INCL. DREDGING)	4,176,000
WORK AREA SLAB	784,000
SLOPE PROTECTION	1,859,000
STORAGE AREA PAVEMENT	3,870,000
DEWATERING	830,000
BUILDINGS	690,000
UTILITIES	100,000
FENCE	52,000
TOILETS	104,000
AGGREGATE STORAGE BINS	74,000
WATER & GASOLINE TANKS	24,000
POWER PLANTS	120,000
SERVICE DOCKS	770,000
AIR COMPRESSORS	120,000
WELDING MACHINES	20,000
TRANSPORTATION	10,000
ENGINEERING	1,128,000
TOTAL CONST. COST	$ 15,483,000

ASSUME 4 USES ⇒ 25% OF $ 15.48 MM = $ 3.87 MM

ASSUME COST IN JAPAN = 85%

→ 0.85 × 3.87 = $ 3.29 MM

CONSTRUCTION COSTS - JAPAN

W. D. = 300 FT

100,000 BOPD

- CONSTRUCTION SITE
- CONCRETE STRUCTURE
- TOPSIDES
- TOW TO FIELD
- INSTALLATION & COMISSIONING
- ENGINEERING & MANAGEMENT

CONCRETE STRUCTURE

COSTS - JAPANESE DATA

ASSUME :

CONCRETE : 95% VOLUME

REINFORCEMENT : 4% *

POST-TENSIONING : 1% *

UNIT COSTS :

NORMAL WEIGHT CONCRETE = US $ 147.06 / yd^3

STEEL REINFORCEMENT = $ 931.88 / Ton

POST-TENSIONING = $ 3820.40 / Ton

FORMWORK = $ 4.66 / ft^2

* UNIT WEIGHT = 490 lb / ft^3

SKIRTS

Volume = 794 yd^3

∴ Concrete = 0.95 × 794 yd^3 = 754.30 yd^3
@ US $ 147.06 / yd^3 $110,927.36

Steel Reinforcement = 0.04 × 794 = 31.76 yd^3
=> 210.09 Ton
@ US $ 931.88 / Ton $ 195,778.67

Post Tensioning = 0.01 × 794 = 7.94 yd^3
=> 52.52 Ton
@ US $ 3820.40 / Ton $ 200,647.41

Formwork = 28,600 ft^2
@ US $ 4.66 / ft^2 $ 133,276.00

US $ 640,629.44

BASE SLAB:

Volume = 18,719 yd^3

∴ Concrete = 0.95 × 18,719 = 17,783.05 yd^3
@ US$ 147.06/yd^3 → $ 2,615,175.33

Steel Reinforcement = 0.04 × 18,719
= 748.76 yd^3 ⇒ 4953.05 Ton
@ US$ 931.88 / Ton → $ 4,615,648.23

Post-tensioning = 0.01 × 18,719
= 187.19 yd^3 ⇒ 1238.26 Ton
@ US$ 3820.40 / Ton → $ 4,730,648.50

Formwork = 144,400 ft^2
@ US$ 4.66 / ft^2 ⇒ $ 672,904.00

US$ 12,634,376.07

WALLS

Volume = 89,663 yd^3

∴ Concrete = 0.95 × 89,663 = 85,179.85 yd^3
@ US$ 147.06/yd^3 ⇒ $12,526,548.74

Steel Reinforcement = 0.04 × 89,663
= 3,586.52 yd^3 ⇒ 23,724.83 Ton
@ US$ 931.88/Ton ⇒ $22,108,694.58

Post-tensioning = 0.01 × 89663
= 896.63 yd^3 ⇒ 5,931.21 Ton
@ US$ 3820.40/Ton ⇒ $22,659,594.68

Formwork = 1,404,000 ft^2
@ US$ 4.66/ft^2 ⇒ $6,542,640.00

US$ 63,837,478.00

FLOAT OUT FROM GRAVING YARD:

Pump, barges, tugs, winches, including crew, fuel, supervision, etc.

10 days @ $ 70,000/day

⇒ $ 700,000

Miscellaneous $ 300,000

$ 1,000,000

MOORINGS DURING CONSTRUCTION AFLOAT

Materials (delivered to site)	$ 1,500,000
Installation:	
15 days @ $ 100,000/day	$ 1,500,000
	$ 3,000,000

TOP SLAB

Volume = 9,157 yd^3

∴ Concrete = 0.95 × 9,157 = 8,699.15 yd^3
@ US$ 147.06 / yd^3 ⇒ $1,279,297.00

Steel Reinforcement = 0.04 × 9,157
= 366.28 yd^3 ⇒ 2,422.94 Ton
@ US$ 931.88 / Ton ⇒ $ 2,257,889.33

Post-tensioning = 0.01 × 9,157
= 91.57 yd^3 ⇒ 605.74 Ton
@ US$ 3820.40 / Ton ⇒ $2,314,169.10

Formwork = 133,800 ft^2
@ US$ 4.66 / ft^2 ⇒ $ 623,508.00

US$ 6,474,863.42

TOWERS : CONSTRUCTION COST

UNIT COST * (USING SLIP-FORMS) ≅ US $ 720 / yd^3

TOTAL VOLUME 4 TOWERS = 13,260 yd^3

⇒ TOTAL COST = $ 9,547,200

---

* UNIT COST INCLUDING FORMS, MATERIALS, LABOR, OVERHEAD & PROFITS. ALSO ACCOUNTS FOR OFFSHORE CONSTRUCTION.

HULL SYSTEMS COST

ITEM	COST ($MM)
Ballast System	4.0
Sand Undergrouting System	0.7
Oil Storage & Metering	5.0
HVAC System	3.5
Electrical Systems	3.8
Instrumentation & Controls	4.0
Firefighting	3.0
Miscellaneous	3.0
	27.0

TOW CAISSON TO MATING SITE

Use 4 - 9000 HP tugs
@ $ 12,000 /day *, for
4 days (incl. Mob / Demob)
= 4 × 4 × 12,000 = $ 192,000

Towing Hardware,
including installations $ 500,000

$ 692,000

* Crowley Maritime, 7/22/85.
This cost includes crew, nominal fuel

A 4.27

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
		PAGE OF
SYSTEM:		ORIGINATOR:
CALCULATION FOR :		DATE :
		REVIEWER :
		DATE :
		REVISION :
		RESULTS :

Topside costs are as per jacket. In the deck fabrication cost, the cost of the deck was added to the cost of the module steel, i.e.,

6.0 + 8.8

= 14.4 Total.

See the appropriate jacket case. The drilling / production, accommodation / modules etc have the same cost.

FILING CODE :

TOW DECK TO MATING SITE

Assume use of 3 - 9000 HP tugs @ $ 12,000/day*, for 4 days, including Mob./Demob.

3 × 4 × $ 12,000	= 144,000
Towing Hardware Incl. Install	= 200,000
	$ 344,000

* Crowley Maritime, 7/22/85. Includes crew, nominal fuel

Transport Barge — use either 1 large or 2 small barges as per availability — use $ 1,000,000

MATE DECK TO SUB-STRUCTURE

Submergence Test for Combined Struct. $ 1.1 MM

Deck Mating:

- Assume total of ~~15~~ 15 days for cost-estim.
- 2 Generator / Pump barges @ $ 40K / day
- 4 - 9000 HP Tugs for Sub-structure @ $ 12k / day
- 3 - 9000 HP Tugs for Deck @ $ 12K / day
- Miscellaneous Marine Craft @ $ 20k / day
- Connection Equipment : $ 1 MM
- Operatives : $ 12k / day

⇒ Cost Generator / Pump Barges = 2 × 15 × 40k = 1.2 MM
Tugs = 7 × 15 × 12k = 1.26
Misc. Marine Craft = 15 × 20k = 0.30
Connection Equipment = = 1.00
Operatives 15 × 12k = 0.18

$ 3.9 MM

TOTAL = $ 5.0 MM

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
		PAGE OF
SYSTEM:		ORIGINATOR:
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		REVIEWER:
		DATE:
		REVISION:
		RESULTS:

Tow to Field

Tow preparation $ 1.00

Bandit ballast

	100,000 kayd	50,000 kayd
150 ft	$ 16.3 MM	$ MM 14.5
300 ft	$ 9.7 MM	$ MM 9.7

(costs include material + equipment)

Tow costs

	Tow cost
U.S	$ 9.00 MM
Japan	$ 11.0 MM.

Total costs / Japan

	100000 kayd	50000 kayd.
150 ft	$ 28.3 MM	$ 26.5 MM
300 ft	$ 21.7 MM	$ 21.7 MM

FILING CODE:

4.4.31

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
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SYSTEM:		ORIGINATOR:
CALCULATION FOR:		DATE:
		REVIEWER:
		DATE:
		REVISION:
		RESULTS:

Total Costs / U.S.

	100000 bbl/d	50000 bbl/d
150 ft	$26.3 MM	$26.5 MM
300 ft	$19.7 MM	$19.7 MM

FILING CODE:

A 4.32

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
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		REVIEWER:
		DATE:
		REVISION:
		RESULTS:

Install / commission costs.

Mob D.B + Water ballast $3.2 MM

Spread

	100000 kgd	50000 kgd
150 ft	$10.6 MM	$ 6.6 MM
300 ft	$ 9.8 MM	$ 5.6 MM

(includes material + equipment)

Ballast

	100000 kgd	50000 kgd
150 ft	$ 19.8 MM	$ 16.8 MM
300 ft	$ 21.5 MM	$ 13.2 MM

(includes material + equipment)

Diving Spread $6.7 MM

Demob equipment / Spread $ 1.3 MM

Commission $ 1.0 MM

FILING CODE:

A4.33

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
		PAGE OF
SYSTEM:		ORIGINATOR:
CALCULATION FOR:		DATE:
		REVIEWER:
		DATE:
		REVISION:
		RESULTS:

Total costs

	100000 bpd	50000 bpd
150 ft	$42.6 MM	$35.6 MM
300 ft	$43.5 MM	$31.0 MM

FILING CODE:

A 4.3 Concrete Gravity Platform, 300 ft, 100000 bopd, U.S. West Coast. (A 4.34)

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		41.7
2.	Construction Site (4 Uses)		3.3
3.	Concrete Structure		
	Skirts	0.8	
	Base Slab	15.7	
	Walls	79.1	
	Transport to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	8.0	
	Towers	11.9	
	Hull Systems	27.0	
	Transport to Mating Site	0.7	147.2
4.	Topsides		
	Deck Fabrication	16.2	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	27.0	
	Yard Assembly	65.8	
	Transport and Mate	6.3	203.3
5.	Tow to Field (Incl. part barrite)		19.7
6.	Install & Commission		43.5
7.	Total		458.7

TABLE 7.4.4 COST ESTIMATE FOR CONCRETE GRAVITY PLATFORM, WEST COAST, 100,000 BOPD, 300 FT WATER DEPTH

CONCRETE STRUCTURE COSTS - U.S. WEST COAST

SKIRTS

Concrete	= 754.30 yd^3 × $ 155.36 / yd^3	=	$ 0.117 MM
Steel	= 210.09 Ton × $ 1324.58 / Ton	=	0.278
Post-tensioning	= 52.52 Ton × $ 4540.00 / Ton	=	0.238
Formwork	= 28,600 ft^2 × $ 5.34 / ft^2	=	0.153
		TOTAL =	$ 0.787 MM

BASE SLAB

Concrete	= 17,783 yd^3 × $ 155.36 / yd^3	=	$ 2.763 MM
Steel	= 4953 Ton × $ 1324.58 / Ton	=	6.561
Post-tensioning	= 1238 Ton × $4540 / Ton	=	5.621
Formwork	= 144,400 ft^2 × $ 5.34 / ft^2	=	0.771
		TOTAL =	$ 15.715 MM

WALLS

Concrete	= 85,180 yd^3 × $ 155.36 / yd^3	=	$ 13.234 MM
Steel	= 23,725 Ton × $ 1324.58 / Ton	=	31.426
Post-tensioning	= 5931 Ton × $ 4540 / Ton	=	26.927
Formwork	= 1,404,000 ft^2 × $ 5.34 / ft^2	=	7.497
		TOTAL =	$ 79.083 MM

TOP SLAB

Concrete	= 8,699 yd^3 × $ 155.36 / yd^3	=	$ 1.351 MM
Steel	= 2,423 Ton × $ 1324.58 / Ton	=	3.209
Post-tensioning	= 606 Ton × $ 4540 / Ton	=	2.751
Formwork	= 133,800 ft^2 × $ 5.34 / ft^2	=	0.714
		TOTAL =	$ 8.027 MM

A4.4 Concrete Gravity Platform, 150 ft, Japan, 100000 bopd

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		32.7
2.	Construction Site (4 Uses)		3.3
3.	Concrete Structure		
	Skirts	1.0	
	Base Slab	12.3	
	Walls	34.3	
	Transport to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	6.4	
	Towers	5.4	
	Hull Systems	25.0	
	Transport to Mating Site	0.7	89.1
4.	Topsides		
	Deck Fabrication	14.4	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	24.0	
	Yard Assembly	30.8	
	Transport and Mate	6.3	163.5
5.	Tow to Field (Incl. part barrite)		28.3
6.	Install & Commission		42.6
7.	Total		359.5

TABLE 7.4.1 COST ESTIMATE FOR CONCRETE GRAVITY PLATFORM, JAPAN, 100,000 BOPD, 150 FT WATER DEPTH

A 4.38

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		37.9
2.	Construction Site (4 Uses)		3.3
3.	Concrete Structure		
	Skirts	1.2	
	Base Slab	15.3	
	Walls	42.5	
	Transport to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	7.9	
	Towers	6.7	
	Hull Systems	25.0	
	Transport to Mating Site	0.7	103.3
4.	Topsides		
	Deck Fabrication	16.2	
	Drilling Facilities	34.0	
	Production Facilities	54.0	
	Quarters Facilities	27.0	
	Yard Assembly	65.8	
	Transport and Mate	6.3	203.3
5.	Tow to Field (Incl. part barrite)		26.3
6.	Install & Commission		42.6
7.	Total		416.7

TABLE 7.4.3 COST ESTIMATE FOR CONCRETE GRAVITY PLATFORM, WEST COAST, 100,000 BOPD, 150 FT WATER DEPTH

A 4.5 Japan, 50000 bopd

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		29.0
2.	Construction Site (4 Uses)		3.3
3.	Concrete Structure		
	Skirts	0.5	
	Base Slab	9.1	
	Walls	42.3	
	Transport to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	4.7	
	Towers	9.6	
	Hull Systems	27.0	
	Transport to Mating Site	0.7	97.9
4.	Topsides		
	Deck Fabrication	12.0	
	Drilling Facilities	20.0	
	Production Facilities	54.0	
	Quarters Facilities	18.0	
	Yard Assembly	26.0	
	Transport and Mate	6.3	136.3
5.	Tow to Field (Incl. part barrite)		21.7
6.	Install & Commission		31.0
7.	Total		319.2

TABLE 7.4.6 COST ESTIMATE FOR CONCRETE GRAVITY PLATFORM, JAPAN, 50,000 BOPD, 300 FT WATER DEPTH

A4.40

		($MM)	
1.	Engineering & Management		
	Marine Insurance (10%)		26.7
2.	Construction Site (4 Uses)		3.3
3.	Concrete Structure		
	Skirts	0.5	
	Base Slab	6.2	
	Walls	19.7	
	Transport to Deeper Water	1.0	
	Temporary Moorings	3.0	
	Top Slab	3.5	
	Towers	5.4	
	Hull Systems	25.0	
	Transport to Mating Site	0.7	65.0
4.	Topsides		
	Deck Fabrication	12.0	
	Drilling Facilities	20.0	
	Production Facilities	54.0	
	Quarters Facilities	18.0	
	Yard Assembly	26.0	
	Transport and Mate	6.3	136.3
5.	Tow to Field (Incl. part barrite)		26.5
6.	Install & Commission		35.6
7.	Total		293.4

TABLE 7.4.5 COST ESTIMATE FOR CONCRETE GRAVITY PLATFORM, JAPAN, 50,000 BOPD, 150 FT WATER DEPTH

A.5.0 FLOATING PRODUCTION/STORAGE

A5.1 FPSO Cost Estimate A5.2

ITEM	COST ($MM)	
1. Engineering/Management		
Marine Insurance (10%)		16.3
2. Production Tanker		
Purchase	7.5	
Modifications	21.9	
Outfitting	59.0	
Ice Strengthening	15.0	
Shipyard Fee	7.2	
Tow to Location	0.7	
Installation	0.2	111.5
3. Mooring System		
Materials & Fabrication	4.2	
Transportation	0.7	
Installation	1.6	6.5
4. Subsea System		
Materials & Fabrication	22.8	
Transportation	1.2	
Installation	4.8	28.8
5. Risers		
Materials & Fabrication	9.6	
Transportation	0.7	
Installation	1.7	12.0
6. Test & Commission		3.5
TOTAL		178.6

TABLE 9.3.1 FPSO COST ESTIMATE

A 5.3

A 5.2 FSO Cost Estimate

ITEM	COST ($MM)	
1. Engineering/Management		
Marine Insurance (10%)		9.0
2. Storage Tanker		
Purchase	7.5	
Modifications	13.3	
Outfitting	39.6	
Ice Strengthening	15.0	
Shipyard Fee	4.3	
Tow to Location	0.7	
Installation	0.2	80.5
3. Mooring System		
Materials & Fabrication	4.2	
Transportation	0.7	
Installation	1.6	6.5
4. Risers		
Materials & Fabrication	0.9	
Transportation	0.8	
Installation	0.8	2.5
5. Test & Commission		0.3
TOTAL		98.8

TABLE 9.3.6 FSO COST ESTIMATE

A5.3 Remote loading Buoy Cost Estimate

ITEM		COST ($MM)
1. Engineering/Management		
Marine Insurance (10%)		0.7
2. Mooring System		
Materials & Fabrication	0.4	
Transportation	0.6	
Installation	1.6	2.6
3. Risers		
Materials & Fabrication	2.5	
Transportation	0.6	
Installation	0.6	3.7
4. Test & Commission		0.2
TOTAL		7.2

TABLE 10.3.1 REMOTE LOADING BUOY COST ESTIMATE

A5.5

BRIAN WATT ASSOCIATES, INC.
CONSULTING ENGINEERS
HOUSTON, TEXAS

CLIENT: J. I.
PROJECT: N. Aleutians
FILING CODE:
JOB NO. 284
PAGE 1 OF
ORIGINATOR: R. Ay
DATE: 8/13/85
REVIEWER:
DATE:
REVISION:
RESULTS:

SYSTEM:

CALCULATION FOR: Costing Calculations

FPSO

Used 126,000 DWT tanker $5 - $10 million
use $7.5 million

Tanker modifications
$18,660,000 {previous BWA study}
+ 87,000 shuttle mooring/offloading
+ 2281,000 process cover ($1/pound)
$21,028,000 + 850,000 yard mobilization

Outfit
$ 39,000,000 {previous BWA study}
+ 15,000,000 mooring turret
+ 2,000,000 swivel
$59,000,000

Shipyard Fee 9% (21,028,000 + 59,000,000) ≈
$7,200,000

FSO

Used 126,000 DWT tanker $7.5 million

Tanker modifications
$18,660,000
- 712,000 equipment foundation
- 5,810,000 deck strengthening
+ 87,000 shuttle mooring/offloading
$12,225,000 + 850,000 yard mobilization

Outfit
$59,000,000 (see above)
- 9,200,000 process equip
- 1,930,000 miscell equip
- 7,760,000 additional generators
- 500,000 swivel (deduction, not cost)
$39,609,000

Shipyard Fee 10% (12,225,000 + 31,209,000) =
$4,343,400

FILING CODE:

A 5.6

BRIAN WATT ASSOCIATES, INC.
CONSULTING ENGINEERS
HOUSTON, TEXAS

CLIENT: J. I.

PROJECT: N. Aleutians

FILING CODE:

JOB NO. 284

PAGE 3 OF

ORIGINATOR: R. Ay

DATE: 8/13/85

REVIEWER:

DATE:

REVISION:

SYSTEM:

CALCULATION FOR: Costing Calculation

RESULTS:

FPSO SYSTEM TOW TO/FROM SITE

① Tow FPSO tanker from Seattle/San Francisco to N. Aleutians. (round trip)

1 14000 IHP Tug, 20 days 550^k
× 1.2 contingency = $660^k

② Mooring System

2 250 × 76 barges @ 1.2^k/day
2 5000 IHP Tugs @ 9.5^k/day
} 10.7^k/day

2 14 day trips (San Francisco/Japan)
2 × 28 × 10.7 = 599.2^k
× 1.2 contingency = $719^k

③ Flex Riser System

2 250 × 76 barges @ 1.2^k/day
2 5000 IHP Tugs @ 9.5^k/day
} 10.7^k/day

2 14 day trips (San Francisco/Japan)
2 × 28 × 10.7 = 599.2^k
× 1.2 contingency = 719^k

④ Crane Barge w/100 ton Crane & Tug Boat

round trip transit 400^k
× 1.2 contingency = 480^k

⑤ Subsea Equipment

2 250 × 76 barges @ 1.2^k/day
2 5000 IHP tugs @ 9.5^k/day
} 10.7^k/day

2 14 day trips (San Francisco/Japan)
2 × 28 × 10.7 = 599.2^k
× 1.2 contingency = 719^k

$1,199^k$

FILING CODE:

A5.7

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT: J. I.	FILING CODE:
	PROJECT: N. Aleutians	JOB NO. 284
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SYSTEM:		ORIGINATOR: R. Ay
		DATE: 8/13/85
CALCULATION FOR: Costing Calculation		REVIEWER:
		DATE:
		REVISION:
		RESULTS:

FSO SYSTEM TOW (reference, page 3)

tanker	$660 K	
mooring system	$719 K	
crane barge	$480 K	
subsea + riser	$360 K	(1 barge, 1 tug)

SHUTTLE SYSTEM

This transport only includes mooring, riser, and subsea systems.

2 barges w/ tugs	$719 K
crane barge ; tug	$480 K
	$1,199 K

→ 2 @ $0.6 K

FILING CODE:

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CONSULTING ENGINEERS
HOUSTON, TEXAS

CLIENT: J. I.
PROJECT: N. Aleutians
FILING CODE:
JOB NO. 284
PAGE 5 OF
SYSTEM:
ORIGINATOR: R. Ay
DATE: 6/13/85
CALCULATION FOR: Costing Calculations
REVIEWER:
DATE:
REVISION:
RESULTS:

FPSO/FSO MOORING Installation

2 barges w/ tugs @ $10.7^k/day = $21.4^k/day
8 days to install each leg
8 legs

3 × 8 × 21.4 = 513.6
1.2 contingency × 513.6 = $616.3^k

crane barge @ $35^k/day × 24 days × 1.2 = $1,008^k

total = $1,624.3^k

FPSO SUBSEA INSTALLATION

4 days each PLEM = 32 days
1 week for each template = 56 days
(includes pile driving)
$10.7^k/day barges & tugs
$35^k/day crane barge

$45.7^k × 88 = $4,021.6^k × 1.2 contingency = $4,826^k

FPSO RISER INSTALLATION

3 days / riser (8) = 24 days × 1.2 = 29 days

4 days f/ mobilization etc. 4
33 days

cost/day equip, crews, fuel etc = $51^k

33 × 51 = $1,683^k

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BRIAN WATT ASSOCIATES, INC.
CONSULTING ENGINEERS
HOUSTON, TEXAS

CLIENT: J. I.
PROJECT: N. Aleutians

FILING CODE:
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PAGE 6 OF
ORIGINATOR: R. Ay
DATE: 8/13/85
REVIEWER:
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SYSTEM:

CALCULATION FOR: Costing Calculations

RESULTS:

FPSO / FSO Tanker Install

$200^k for mooring / riser hookup

FSO SUBSEA INSTALLATION

1 barge w/ tug @ $10.7^k / day
1 crane barge @ $35^k / day
$45.7^k / day

use 4 days for PLEM install & hookup

$4 \times 45.7 = \$183^k$

FSO RISER INSTALLATION

3 days to install riser
5 days hookup & test

8 days @ $51^k = \$408^k$

$\$583^k$

SHUTTLE MOORING INSTALLATION

mooring → 3 days / leg $1,624^k same as FPSO/FSO

riser / base → $583^k same as FSO

FILING CODE:

A 5.10

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT: J. I.	FILING CODE:
	PROJECT: N. Aleutians	JOB NO. 284
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SYSTEM:		ORIGINATOR: R. Ay
		DATE: 8/13/85
CALCULATION FOR: Costing Calculations		REVIEWER:
		DATE:
		REVISION:
		RESULTS:

FPSO/FSO Mooring System Purchase

5 3/4" chain →	$4,003 k
attachments →	121 k
8 15 ton anchors →	97 k
	$4,221 k

SHUTTLE MOORING (Remote Loading Buoy)

3" chain →	$320 k
attachments →	17 k
8 5 ton anchors	33 k
	$370 k

SHUTTLE MOORING - CAM costs

upper riser disconnect	$475 k
150 ft riser (20" OD)	404 k
lower riser package	100 k
corrosion prevention, assembly & testing	660 k
	$1,639 k

FINAL TESTING, ALL SYSTEMS (FPSO/FSO/SHUTTLE)

$100 k

FILING CODE:

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT: J. I.	FILING CODE:
	PROJECT: N. Aleutians	JOB NO. 284
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SYSTEM:		ORIGINATOR: R. Ay
		DATE: 8/13/85
CALCULATION FOR: COSTING CALCULATIONS		REVIEWER:
		DATE:
		REVISION:
		RESULTS:

FPSO RISER MATERIALS & FABRICATION

multibore production riser (7)	$2,834,966
end terminations (7 sets)	$6,525,210
	$9,359,576
gas reinjection riser (1)	$87,699
end terminations (1 set)	148,754
	$236,453

TOTAL = $9,596,000

FSO RISER MATERIALS & FABRICATION

export riser	$197,520
end terminations	335,032

TOTAL = $532,552

SHUTTLE RISER MATERIALS & FABRICATION

export riser	$98,760
end terminations	$335,032

TOTAL = $433,792

CAM costs = $1,639^k

Total CAM = 1,639 + 433 = $2,072^k

FILING CODE:

BRIAN WATT ASSOCIATES, INC.
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HOUSTON, TEXAS

CLIENT:

PROJECT:

FILING CODE:

JOB NO.

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SYSTEM:

ORIGINATOR:

DATE:

CALCULATION FOR: SUBSEA EQUIPMENT

REVIEWER:

DATE:

REVISION:

RESULTS:

ESTIMATED WEIGHT 350 TONS

@ 2,000 $ / TON = $ 700000

32 Extra tall guide posts @ $5,000 each = $160,000

Mechanical and Electrical Manifolding (see next section) = $844,000

Total (production template) = $1,704,000

FILING CODE:

PRODUCTION
TEMPLATE MANIFOLDING:

FOR EACH WELLHEAD LOCATION:

(1)	3"-5000# W.P. GATE VALVE W/ACTUATOR	$20,700
(2)	2"-3000# W.P. " "	$25,700
(1)	3" SUBSEA CHOKE W/ACTUATOR	$21,300
(1)	FLOWLINE STAB TYPE RECEPTICLE	$15,000
(1)	SET PIPING TO CORRESPONDING HEADERS	$5,000
		$97,700

PRODUCTION HEADER, 7" OD X 1" WALL TUBING X 70' (4480#)
TEST " , 4" OD X 1/2" WALL " X 70' (1310#)
ANNULUS " do (1310#)
CONTROL " 1 3/4" OD X 3/8" W. (240#)
ELEC CABLE (ARMORED) 400'

PRODUCTION HEADER	($64/FT)	=	$4480
TEST "	($22/FT)	=	1540
ANNULUS "		=	1540
CONTROL "	($6.40/FT)	=	448
CABLE @ $10/FT		=	4000
8 " CONNECTORS @ $3K		=	24000
			$36008
MISC. FITTINGS			2000
FABR & ASSY & TEST			25,000
			63,000
8 WELLHEAD ASSY @ $97,700 =			781,600
			$844,600 - TOTAL

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT: JOINT INDUSTRY	FILING CODE:
	PROJECT: NORTH ALEUTIANS	JOB NO. 284
		PAGE 71 OF
SYSTEM: FIELD REINJECTION EPSD COSTING ASSUMPTIONS - TEMPLATE		ORIGINATOR: MJN DATE: 8-14-85
CALCULATION FOR:		REVIEWER: DATE:
		REVISION:
		RESULTS:

ASSUME SAME STRUCTURE AS PRODUCTION TEMPLATE - $860,000

MECHANICAL & ELECTRICAL MANIFOLDING

(1) INJECTION HEADER, 10" O.D X 1" W. TUBING X 70' (6720 #) @ $100/FT	$7,000
400' ARMORED CONTROL CABLE	$4,000
(8) ELEC. CABLE CONNECTORS	$24,000
(8) 3"-5000# WP VALVE/ACTUATOR @ $20,700 EA	$165,600
(2) STAB RECEPTACLE @ $10,000 EA	$ 20,000
(1) SET MISC. PIPING & FITTINGS	$ 7,000
FAB. & ASSY & TEST	$25,000
	$312,600

- Total $1,173,600

A5.15

BRIAN WATT ASSOCIATES, INC.
CONSULTING ENGINEERS
HOUSTON, TEXAS

CLIENT:

PROJECT:

FILING CODE:

JOB NO.

PAGE OF

SYSTEM:

ORIGINATOR:

DATE:

CALCULATION FOR: PRODUCTION TEMPLATES

REVIEWER:

DATE:

REVISION:

RESULTS:

FLAB (FLOWLINE ANCHOR BASE)

- COMBINATION PERMANENT/TEMPORARY GUIDE BASES WITH GUIDE POSTS, LATCH
- BASE
- 100' of 30" CONDUCTOR PIPE WELDED TO P.G.B. AS A PILE
- MANIFOLDING (INDIV LINES)

ESTIMATE $100,000

PLEM

- BASE (AS FLAB)
- PILES (AS FLAB)

MANIFOLDING INCLUDING

RISER MANUAL PULL IN RECEPTACLE

MANIFOLDING FROM RECEPTACLE (INDIV LINES)

2# ELECTRICAL RECEPTACLES

ESTIMATED COST $250,000

FILING CODE:

A 5.16

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
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SYSTEM:		ORIGINATOR: DATE:
CALCULATION FOR: PRODUCTION TEMPLATES		REVIEWER: DATE:
		REVISION:
		RESULTS:

TEMPLATE TO FLAB

HARD PIPING	$ 8000
1 # ELECTRICAL RECEPTICLE	$ 3000
	11,000

FLAB TO PLEM (10,000' OF LINE)

5" O.D X 1" PIPED LINE	$ 320,000
2# ANNULUS / TEST LINES	$ 320,000
CONTROL LINE	$ 200,000
	$ 840,000

FILING CODE:

A5.17

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO. PAGE OF
SYSTEM:		ORIGINATOR: DATE:
CALCULATION FOR: REINJECTION TEMPLATES		REVIEWER: DATE:
		REVISION:
		RESULTS:

FLAB (AS FOR PRODUCTION DIFF MANIFOLDING)	$1000000
PLEM	$ 250000
TEMPLATE TO FLAB	$ 11,000
FLAB TO PLEM (10000') 10" O.D X 1" Wall	$ 720,000
CONTROL CABLE	$ 150,000
	$ 850,000

FILING CODE:

A5.18

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT:	FILING CODE:
	PROJECT:	JOB NO.
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SYSTEM:		ORIGINATOR: DATE:
CALCULATION FOR:		REVIEWER: DATE:
		REVISION:
		RESULTS:

FPSO PRODUCTION SYSTEM

TEMPLATE	$1,704,000
FLAB	100,000
PLEM	250,000
TEMP → FLAB	11,000
FLAB → PLEM	840,000
TOTAL	2,905,000

TOTAL X 7 = 20,335,000

FPSO INJECTION SYSTEM

TEMPLATE	1,173,000
FLAB	100,000
PLEM	250,000
TEMP → FLAB	11,000
F-LAB → PLEM	870,000
TOTAL	2,404,000

2404000

22,739,000

Note installation of all components is costed elsewhere

FILING CODE:

(A.5.19)

BRIAN WATT ASSOCIATES, INC. CONSULTING ENGINEERS HOUSTON, TEXAS	CLIENT: JOINT INDUSTRY PROJECT: NORTH ALEUTIANS	FILING CODE: JOB NO. 284 PAGE 16 OF
SYSTEM: PIPE LAYING EXPENSES IF USING SANTA FE & PACIFIC		ORIGINATOR: MJN DATE: 8-15-85
~~CALCULATION FOR~~: BASED ON CONVERSATION W/ GARY MATLOCK 460-4070		REVIEWER: DATE: REVISION:
		RESULTS:

1. MOBILIZATION:

   NORTH SEA-ALASKA, 10,000 NAUT. MI. @ 12 Kn @ $100^K/DA = $3,500,000

2. SET UP SHOP AT CUSTOMER'S FACILITY $1,000,000

3. WELDING & HANDLING FLOWLINES $900,000

4. REELING PIPE & ELEC CABLE

   12 DA. @ $165,000 = $1,980,000

5. 2 DA. MANNING @ $165^K $330,000

6. ~~48~~ 48 DA. LAYING & HOOK-UP @ $165^K $7,920,000

7. 10 DA. TO & FROM FACILITY BETWEEN PIPELINES $1,650,000

8. 2 DA. DE-MANNING $330,000

9. DEMOBILIZATION $3,500,000

$21,110,000

NOTE:

1. PIPELINE MAT'L COSTED ON PREVIOUS PAGES

FILING CODE: