FIXED VERSUS DISCONNECTABLE TURRET SYSTEM

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ABSTRACT

With the anticipated development of a large number of fields offshore in the South China Sea in the areas know as typhoon alley, there is a need for the owners and operators of the field to evaluate a fixed versus disconnectable turret moored system for FSO's and FPSO's in terms of CAPEX, OPEX and system availability during service life which impacts "Lost Production and Risk". These two turret mooring systems are each unique and result in differences in general arrangements, operational characteristics and life of field costs. The selection of which turret mooring system for a FSO or FPSO is complex as it depends on a variety of factors including environmental conditions, field layout, production rates, storage capacity, offloading frequency and typhoon shutdown.

This paper presents information and results that allow a structural evaluation of fixed versus disconnectable turret moored FSO's and FPSO's from a technical, commercial and operational viewpoint. The objective of the paper is to provide a guide to the decision making process of the appropriate selection of the FSO or FPSO based on comparative turret mooring and fluid-transfer issues, CAPEX, OPEX, Lost Production and Risk due to typhoons.

This paper compares fixed and disconnectable turret mooring systems by:

- Defining typical design parameters for the two systems;
- Evaluating the turret mooring and fluid-transfer systems;
- Contrasting the engineering, procurement, construction and field installation costs (CAPEX);
- Assessing operational consideration such as system availability, Lost Production, product offloading and OPEX for life of field; and
- Evaluating Risk due to typhoons.

The example used to illustrate the selection process between the two systems is a generic field in the South China Sea in the area known as typhoon alley. The example presents results from the global analysis to allow comparison of the mooring and riser performance and availability of the production and offloading systems. Cost estimates of the two systems are presented showing the breakdown among various components and comparisons between the two based on CAPEX, OPEX, system availability, Lost Production and Risk.

This paper provides a mechanism to help owners and operators to evaluate FSO and FPSO options with both types of turret mooring systems

INTRODUCTION

The first turret mooring in the offshore industry was used on the "Discover" class drillships developed in the late 1960's by the Offshore Company. This background of experience combined with Single Point Mooring technology has led to the use of turret moored vessels for offshore production and storage application.

Fixed mooring systems for floating, storage and offloading (FSO) and floating, production, storage and offloading (FPSO) vessels have been in use since the mid 1970's. These systems are normally designed for a 100-year storm conditions and have been employed worldwide. Although complex, they are relatively straightforward to design. However, fixed mooring systems in harsh environments (particularly those produced by seasonal cyclonic weather systems) are not always the most cost effective.

Image 1 Fixed turret for Amoco Orient Petroleum Co., People's Republic of China, Liuhua 11-1 Field, Nan Hai Sheng Li FPSO

The disconnectable mooring systems provide an alternate solution for the production and storage of these fields.

The first disconnectable turret was developed in the mid 1980's for the "JABIRU" field in the Timor Sea between Australia and Indonesia, an area frequented by severe cyclones during parts of the year. The decision to utilize a disconnectable turret for the "JABIRU" field was driven by economics after it was determined that a permanent fixed system which was technically feasible and relatively straightforward to design was far more expensive than the lighter, more complex disconnectable design for this project.

Image 2 Disconnectable turret for JHN, People's Republic of China - Lufeng 13-1 Field, for Nan Hai Sheng Kai FSO

There are about six (6) FSO's and nine (9) FPSO's presently in the South China Sea Area with nine (9) units fixed and six (6) units disconnectable.

Image 3 South China Sea Area

This paper evaluates the fixed versus disconnectable FSO and FPSO mooring systems for an average South China Sea with parameters as shown in Table 1 "100-YEAR SURVIVAL TYPHOON CONDITIONS". The field is a medium range field to be developed in an area having seasonal cyclonic weather systems. This Case assumes the following design criteria:

- The water depth is 150 m,
- The FSO or FPSO has 1.25 million barrels of cargo storage (approximately 170,000 dwt tanker),
- The offloading tankers are up to 150,000 dwt,
- The field life is 20 years,
- The oil production rate for the FPSO is 100,000 bopd and the offloading rate is 50,000 barrels/hour for a parcel size up to one million barrels

There are many prospects similar to this criteria that are presently under consideration for the South China Sea Area today.

This paper will attempt to guide you through the process that is involved in selecting which mooring system is suitable for your application. This is done by the two cases that will be discussed in this paper and then comparing them using a set number of design parameters and deciding the most viable solution based on the analytical results.

DESIGN CRITERIA FACTORS

Environment:

Typhoon for this case is shown in the evaluation of history of the typhoons in the Section 6 "TYPHOONS SOUTH CHINA SEA AREA". This section shows that the typical cyclonic season mainly occurs in the last half of the year. The FSO's and FPSO's average shutdown time is three (3) times a year where shutdown of storage and production occurs and the crew must leave the area. The survival environment assumed design conditions for the 100-year typhoon are the following:

- Collinear: Wind and current collinear with waves.
- Crossed Option 1: Current acting 30 degrees to wind and waves.
- Crossed Option 2: Current acting 45 degrees to wind and waves.

Field Characteristics:

Water Depth: 150 meters

Soils Conditions: Assume suitable for high-holding power drag-embedment anchors

Production Criteria:

Production: 100,000 bopd

Field Life:

Twenty (20) year field life

Flexibility-Operability-Risk:

These factors must be analyzed in accordance with the field parameters of the field being evaluated.

100-YEAR SURVIVAL TYPHOON CONDITIONS				
STORMS / DIRECTIONALITY		100-YEAR TYPHOON		
		Collinear	Option 1	Option 2
CURRENT	Velocity @ Surface (m/s)	2.33	2.33	2.33
	Direction (deg)	180	210	225
WIND	Velocity (m/s, 1 minute)	52.1	52.1	52.1
	Direction (deg)	180	180	180
WAVE	Significant Height (m)	12.1	12.1	12.1
	Peak Period (s)	13.8	13.8	13.8
	Peak Parameter	3.3	3.3	3.3
	Direction (deg)	180	180	180

TABLE 1 – 100 Year Survival Typhoon Conditions

DESIGN BASIS

The Design Basis for this paper uses the following criteria, which represent a normal range for a typical marginal field in the South China typhoon area.

Water Depth: 150 meters

Service Life: 20 years

Vessel: 170,000 dwt
Storage: 1,250,000 barrels
Maximum Offloading Parcel: 1,000,000 barrels
Oil Production: 100,000 barrels oil/day
Gas Production: 130 MMsfd

Pressure at Vessel:	285 psig
Offloading Rate:	50,000 barrels/hr

Risers:

12" Production:	3 Lines
Umbilicals:	3 Lines

CASE STUDY

This section of the paper utilizes two case studies to illustrate the differences between utilizing a fixed turret moored FSO or FPSO versus a disconnectable turret moored FSO or FPSO both in terms of design and performance, and also in terms of CAPEX, OPEX, Lost Production and Risk. The two case studies are based on hypothetical marginal fields in the South China Sea Area. Environmental data typical for the region has been used to evaluate the system performance described in the case studies.

CAPEX, OPEX, Lost Production and Risk estimates are made consistently for both systems based on common subsystems and relative operational expenses. As a final comparison a Present Value (PV) estimate is made for both systems, allowing for a direct comparison of total cost of each system at the first oil milestone. The following sections provide a description of the global system analysis and financial analysis performed and then a detailed description and evaluation of the two case studies.

GLOBAL ANALYSIS

Each FSO and FPSO turret mooring systems was analyzed and designed with sufficient detail to provide a +/- 15% accurate cost estimate. Care was taken to ensure consistent analysis, design methodology and design margins between the fixed and disconnectable turret moored FSO or FPSO for each case study. The global analysis and design was performed with state-of-the-art industry analysis tools and design methodology. This allowed a consistent development of the mooring system design for both systems including the definition of all anchor leg components, anchors, fairleads and required vessel-based installation equipment. In addition system loads (turret loads) and responses were computed for both systems, thus allowing an evaluation of the vessel motions and associated production system relative downtime analysis. The offloading system design and performance as a function of the mooring system and environment was also obtained from a detailed numerical analysis of the offloading operation with export tankers of opportunity and tug assistance.

FINANCIAL ANALYSIS BASIS AND METHODOLOGY

The financial analysis performed in this paper provides a means of comparing the two FSO or FPSO turret mooring systems and is considered to be accurate within +/- 15%.

The design basis for the two cases, the various sub-systems and components are identified to determine the appropriate CAPEX of the common sub-systems between the two turret mooring systems, including engineering, management, fabrication/assembly costs. For the purpose of this paper the CAPEX costs were accumulated for the following sub-systems based on present costs with typical profit and overhead rates.

- Mooring: This includes all systems of the mooring to vessel load-transfer system including anchor leg components, fairleads and chain stoppers, the turret structure, mooring installation equipment, etc.

- Fluid-Transfer: This includes all equipment required for fluid-transfer from the risers to the topsides production stream. This includes manifolding, pig launching and receiving, swivel stack, riser specific installation equipment and etc.

- Hull Systems: This includes the turret moonpool, bilge keels and etc.

- Topside Systems: This includes equipment specific to topside system cost due to turret mooring system selection, e.g. metering, chemical injection skids, electrical and hydraulic systems that may be located in the turret system, modifications to topsides to accommodate the selection of either system and etc.

- Offloading System: This includes the specific offloading system components required for the mooring system. This also includes offloading system related equipment onboard the vessel.

- Installation: This includes all installation costs to install and hook-up the FSO or FPSO to the turret mooring and offloading system.

- Service and Administration: This includes all engineering, management, procurement and mark-up costs associated with each of the turret moored systems specific items described above.

The operational costs (OPEX) of the two systems are also estimated within +/- 15% accuracy again focusing only on the costs that are specifically related to the turret mooring system selection. We have also assumed an inflation rate of 2% per year. The OPEX estimates are based on:

- Demurrage: Tanker demurrage time and charges.
- Maintenance and Inspection: This includes all maintenance and inspection requirements for the turret mooring and offloading systems specific components.
- Offloading Tugs and Pilots: This includes the costs for offloading assistance from support vessels and pilots required for navigating around the FSO or FPSO.
- Difference in Crew Costs: Disconnectable crew must contain a complete maritime crew required for sailing vessel.
- Typhoon Evacuation Costs: All associated costs with crew evacuation during typhoon.

The Lost Production and Risk are costs resulting from shutdown due to typhoon, which has an average of about three (3) times a year for a vessel in the South China Sea Area. The typhoon shutdown is discussed in the next section "TYPHOONS SOUTH CHINA SEA AREA.

The Present Value (PV) of the two systems serves as a method of comparing the total cost of the mooring systems on the same time reference, accounting for inflation and the present value of future expenses. The PV for both case studies are based on a 10.5% discount rate computed from the first oil milestone.

TYPHOONS SOUTH CHINA SEA AREA

The Naval Pacific Meteorology and Oceanography Center / Joint Typhoon Warning Center (JTWC) have been recording all typhoons since 1959 for the Southwest Pacific Ocean and Southern Indian Ocean.

Table 2[1] "Typhoons South China Sea Area, 1959 to 2001 - 42 Years" gives the year, month, name and maximum sustained surface wind speed in knots.

A typhoon is a storm that attains at least 64 knots sustained surface winds during its lifetime. One of the most awesome natural forces on earth is the super typhoon. The first known reference to the term was by Kinney (1955) when he used it to describe large typhoons in general. The first official use of the term by JTWC was in their 1963 Annual Typhoon Report. Nevertheless, it has attained common usage both as a technical classification and by the news media as a description term for the stronger typhoons. It is quite probable that the 130 knots sustained surface winds during its lifetime delineation was chosen because it is the value, to the nearest 5 knots, that is twice the 64 knots intensity adopted for classification as a typhoon.

The months with all 42 years of typhoons and super typhoons are shown on Figure 1.[2]

The average number of typhoons per year in the South China Sea Area is 6.4 typhoons with 1.2 of that total being super typhoons.

The first alert is started on the FSO or FPSO when a typhoon is within four hundred (400) nautical miles. The FSO or FPSO is evacuated when the typhoon is within three hundred fifty (350) nautical miles. This happens approximately 50% of the time a typhoon enters the South China Sea Area, which results in an average of 3.2 shutdowns a year on the FSO or FPSO.

Figure 2, shown at the end of this paper, shows the average frequency of a typhoon per month over the year with the last half of the year having over eighty-five (85%) percent of the typhoons occurring.

CASE 1: FIXED INTERNAL TURRET SYSTEM

To moor a large tanker in one hundred fifty (150) meters water depth in typhoon conditions requires a robust mooring system. The anchor lines include excursion limiters to stiffen the mooring.

The fixed internal turret system is arranged in three (3) groups 120 degrees apart with three (3) legs in each group. The anchor leg moorings consist of chain, wire and excursion limiter. The excursion limiters are made of additional heavy chain lengths attached to the ground chain and provide additional restoring force to reduce the vessel offsets.

[1] Table 2 is located at the back of this paper.

[2] Figures 1 through 9 are located at the end of this paper.

The mooring leg design is conducted in accordance with the latest edition of API RP-2SK: Design and Analysis of Station Keeping Systems for Floating Structures with the minimum safety factors requirements of 1.67 for intact systems and 1.25 and 1.05 for. damaged systems in equilibrium position and respectively. The safety factors account for the reduction in strength associated with the maximum expected corrosion and wear of chain over the design life of the project.

A steep-S riser configuration would be proposed for this type of project. No interference between anchor legs and the production risers would be permitted under any design stern conditions for intact or damaged mooring system.

The general design specification provided for a one hundred (100) year typhoon requires three directional cases to be investigated as specified in Design Criteria Factors, Environment, Table 1: 100-Year Survival Typhoon Conditions.

On the approach of a typhoon, production is shutdown and the FSO's or FPSO's crew is evacuated by helicopter and returns to the FSO or FPSO when the typhoon has passed and the area declared safe to return and start operating.

CASE 2: DISCONNECTABLE INTERNAL TURRET SYSTEM

The mooring system would be designed also to withstand the 100-year return period non-typhoon environment and be a symmetrical eight (8)-leg system. In the event that a typhoon is expected to approach the area, the production is shutdown, risers are flushed, disconnected and lowered into the spider buoy. The spider buoy is then released from the FSO or FPSO, submerges to a predetermined depth (generally 35 to 40 meters below the surface) where it stabilizes while supporting the risers and the mooring lines. After releasing the spider buoy, the FSO or FPSO will travel to safe waters. When the typhoon has passed, the FSO or FPSO returns to the site, recovers the floating retrieval line, reconnects with the spider buoy and production will quickly start again.

CAPEX

The financial analysis performed for this case study follows that of associated costs for South East Asia area. Figures 3, 4 and 5, present the CAPEX to First Oil for both the fixed and disconnectable internal turret mooring systems with tandem offloading. Figures 3 and 4 provide the relative contribution of the various groupings to the CAPEX for each Case and Figure 5 provides a direct CAPEX comparison in normalized US Dollars. The figures show that the fixed turret system has a lower CAPEX than the disconnectable turret system by approximately 4 to 5% for this Case study. The main difference is the additional cost for engineering and mechanical equipment. But the increase in engineering and mechanical equipment requirements will not have any impact on the schedule for the FSO or FPSO because the turret engineering and fabrication activities are parallel with the FSO or FPSO topside process equipment activities, and are normally not the project critical path items.

OPEX

FPSO Crew:

Figure 6 shows the Organizational Chart for a typical FPSO crew for Case1 "Fixed Internal Turret System".

Figure 7 shows the Organizational Chart for the same FPSO crew for Case 2 “Disconnectable Internal Turret Sys tem” but will require certain crew members to have their maritime license papers

Typhoon Evacuation Costs:

In Case 1 “Fixed Internal Turret System” the crew must begin shutdown of production approximately four (4) to six (6) hours prior to evacuation. Mos t oil industry crew helicopters carry approximately eighteen (18) persons. The FPSO’s require approximately four (4) to five (5) trips and for FSO’s probably two (2) trips are required to complete evacuation of the crews and then return them after the typhoon has left the area. These are considered in typhoon evacuation costs. The crew must upon return inspect the vessel for typhoon damage and then start-up production in a short time span after given clearance from the typhoon damage inspection.

The crew for Case 2 “Disconnectable Internal Turret System” must also take about four (4) to six (6) six hours to properly shutdown production and disconnect the mooring system and began sailing from site. Upon return to the site, the vessel is reconnected and production is started within a few hours.

Lost Production:

The Lost Production per year is assumed as the following:

LOST PRODUCTION due to Maintenance and Typhoons per Year

	Case 1 – Fixed Turret System	**Case 2 – Disconnectable Turret System**
Process Facilities Maintenance	4 Days	4 Days
Well Major Workover	.5 Days	.5 Days
Downtime Due to Shortage Limitations	4 Days	4 Days
Downtime Due to Typhoons (3 Times)	10 Days	9 Days
Annual Average Lost Production	18.5 Days	17.5 Days

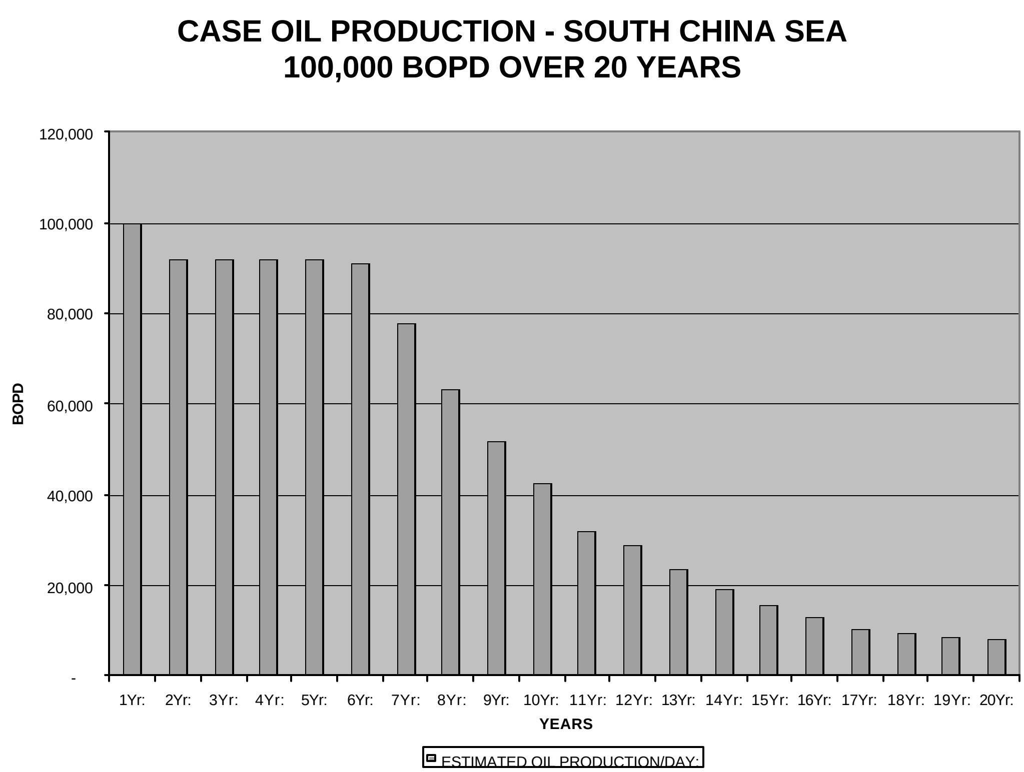

Figure 8 presents a description of the OPEX per year for each of the FPSO turret mooring systems. The figure illustrates that the OPEX normalized over 20 years for the disconnectable turret system is greater than that of the fixed turret system primarily due to turret maintenance costs.

TOTAL COST COMPARISON:

Figure 9 represents a total cost comparison between the Cases. The total cost is presented as the PV at the first oil milestone based on a 10.5% discount rate, 2% inflation per year, and the price of oil in the $20 to $26 per barrel range for the life of the field.

The Figure 9 illustrates that when the total cost of the two systems are compared the Case 1 "Fixed Internal Turret System" has the total lower cost for CAPEX and OPEX but Case 2 has less Lost Production which makes Case 2 total normalized cost about 3.7% less.

RISK:

The risk comparison of the two cases is evaluated in the following Table 3.

RISK FACTORS

Description	Case 1 – Fixed Internal Turret System	Case 2 – Disconnectable Internal Turret System
FSO or FPSO	Hull, topside equipment and mooring system must be designed for 100-year survival typhoon conditions and stay on location for 15 years with all maintenance done offshore.	Since the vessel leaves the site as the typhoon approaches, the hull, topside equipment and mooring system will be designed for much lower load conditions than the 100 year typhoon conditions. Also the vessel has the additional option of leaving for drydock maintenance such as every five years or in an unexpected maintenance requirement.
Crew	Crew must be evacuated by helicopters as the typhoon approaches.	Crew will sail on vessel as the typhoon approaches.

CONCLUSION:

This paper provides an overview of the comparison of the two cases, describing the advantages and disadvantages of each Case.

The two Cases demonstrated that when making a cost, performance and risk comparison, the total cost of the FSO or FPSO mooring and offloading systems must account for CAPEX, OPEX, System Performance and risk over the life of the field.

The results of this case study indicate that for an average South China Sea Area field, cost and risk factors must both be considered in evaluation.

The results show that Case 1 "Fixed Internal Turret System" cost less for both CAPEX and OPEX, but that Case 2 "Disconnectable Internal Turret System" has the lowest Cost Production and Risk on design, crew safety and the additional flexibility of drydocking if required.

A point to remember is that as the water depth increases, the CAPEX of the Fixed Turret Mooring System will increase significantly faster than the Disconnectable System. Also, for each crew evacuation for the Case 1 "Fixed Internal Turret System", one must consider how many helicopters are required and what other offshore production area location crews must also be evacuated before a final decision is made on which turret system to use.

REFERENCES

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2. O. Ihonde, J. Mattinson and L.T. England (2002), FPSO Mooring and Offloading System Alternatives for Deepwater West Africa, presented at the 6th Annual Offshore West Africa Conference, March 2002.

3. R.H. Gruy, C.O. Etheridge, M.J. Krafft (1993), Design and Construction of a Disconnectable Turret Mooring for an FSO in the South China Sea, presented at the FPSO Technology Symposium, February 1993.

4. R.A. Hall, C.O. Etheridge, P.F. Poranski, L.T. Boatman (1994), Installation, Testing, and Commissioning of a Disconnectable Turret Mooring for an FSOU Vessel in a Typhoon Prone Area, presented at Offshore Technology Conference, May 1994.

Figure 1
TYPHOONS SOUTH CHINA SEA AREA
1959 TO 2001 - 42 YEARS

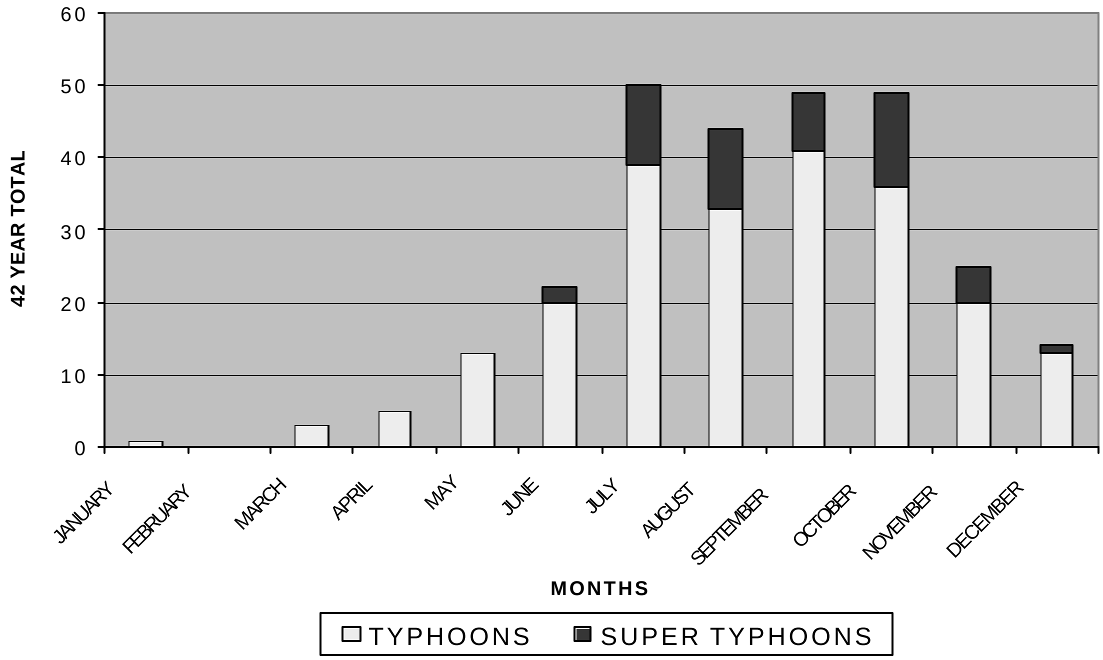

Figure 2
TYPHOONS SOUTH CHINA SEA AREA
ANNUAL AVERAGE 50% EVACUATION

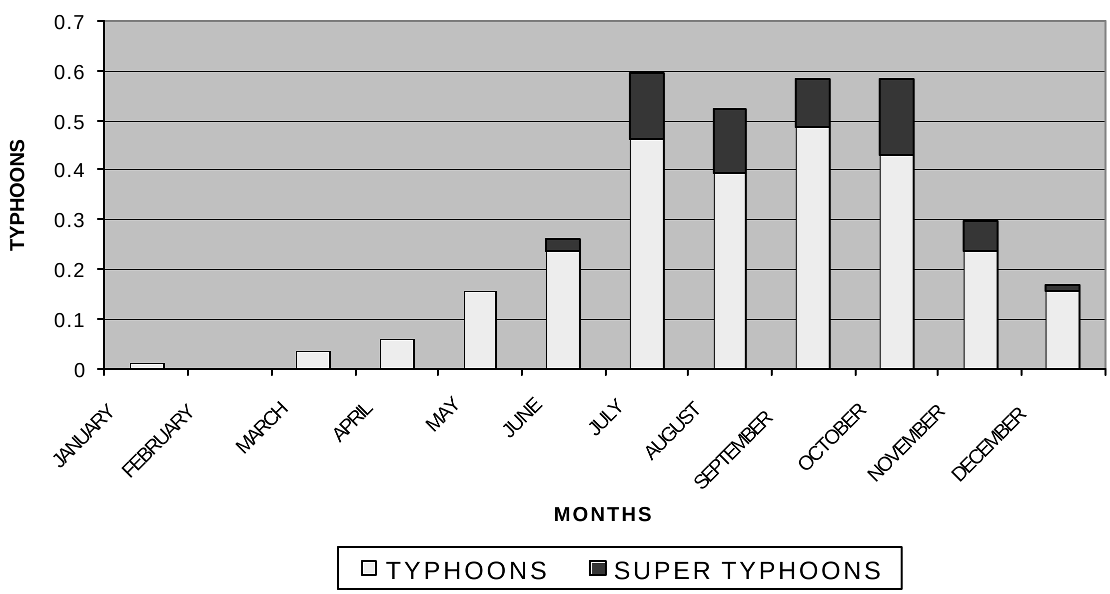

Figure 3
CAPEX - CASE 1 SOUTH CHINA SEA
FIXED INTERNAL TURRET MOORING SYSTEM w/ TANDEM OFFLOADING

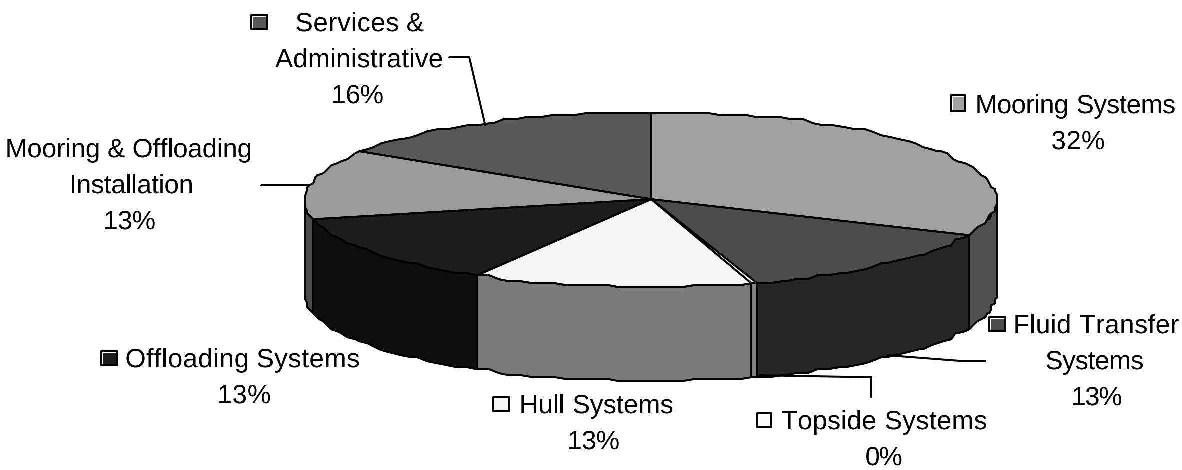

Figure 4
CAPEX - CASE 2 SOUTH CHINA SEA
DISCONNECTABLE INTERNAL TURRET MOORING SYSTEM w/ TANDEM OFFLOADING

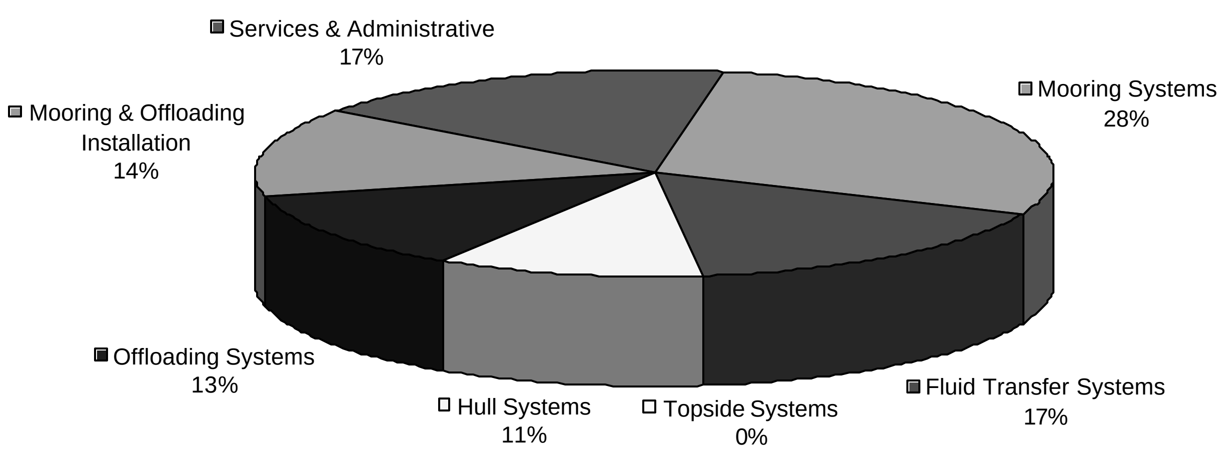

Figure 5
OSEA 2002
CAPEX - CASE SOUTH CHINA SEA

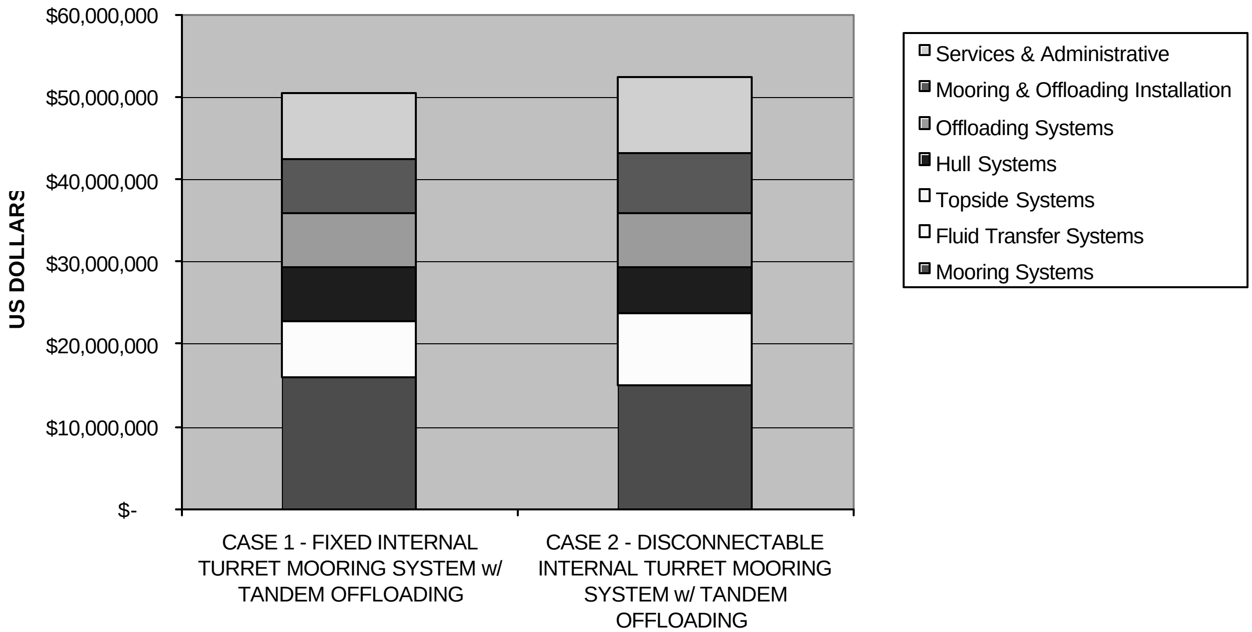

Figure 6

CASE 1 - FIXED TURRET SYSTEM

FPSO CREW COMPLEMENT (43)

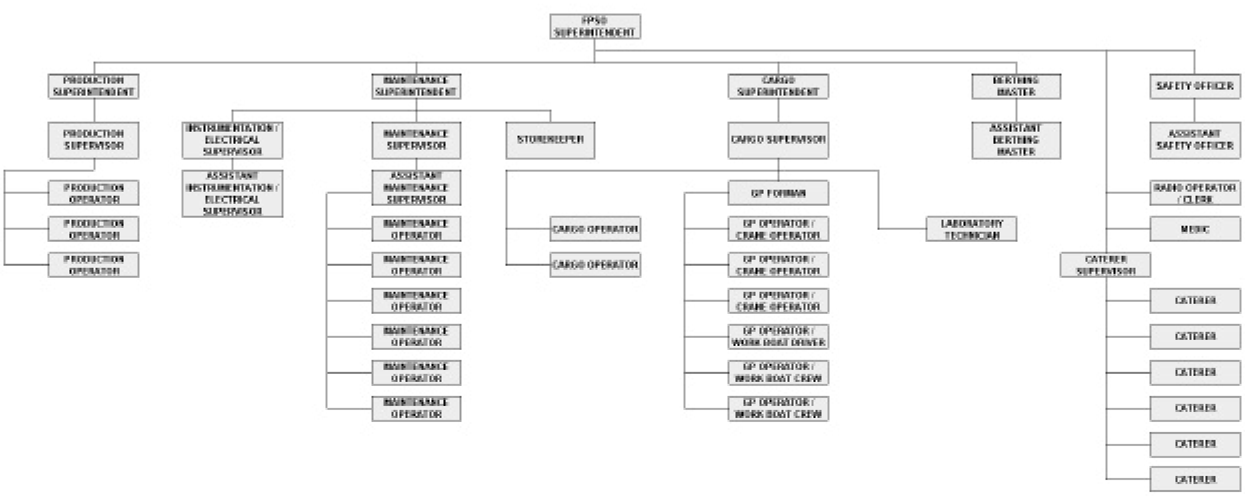

Figure 7

CASE 2 - DISCONNECTABLE TURRET SYSTEM

FPSO CREW COMPLEMENT (43)

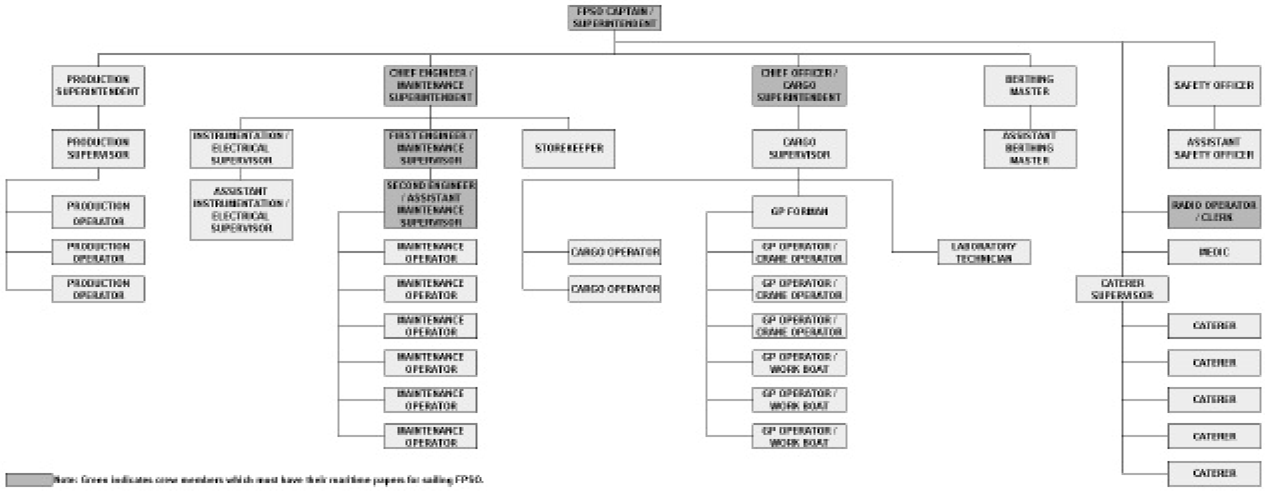

Figure 8

OPEX

AVERAGE TWENTY YEAR OPERATION

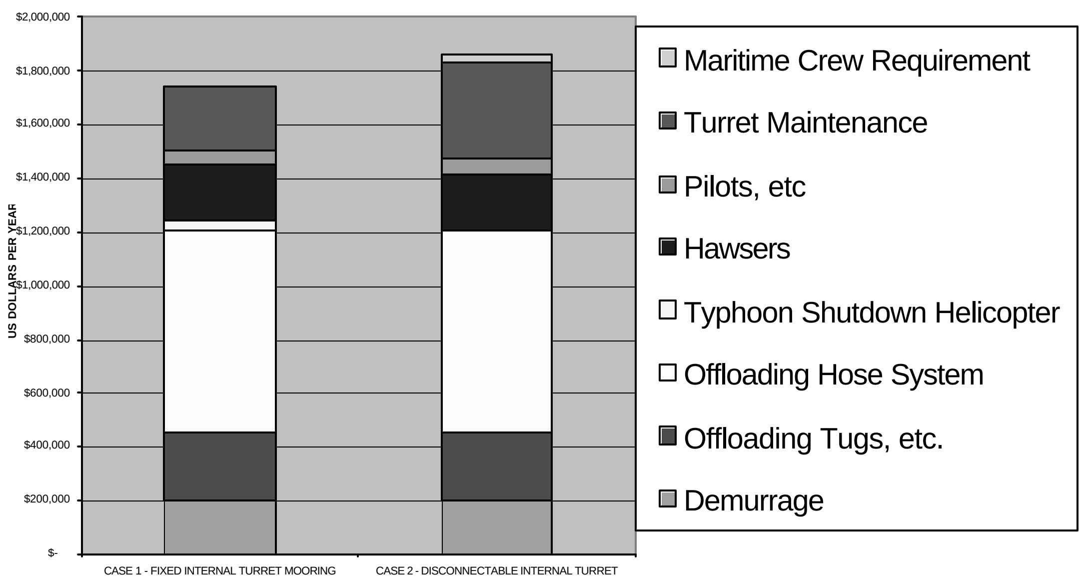

Figure 9 - Present Value at First Oil

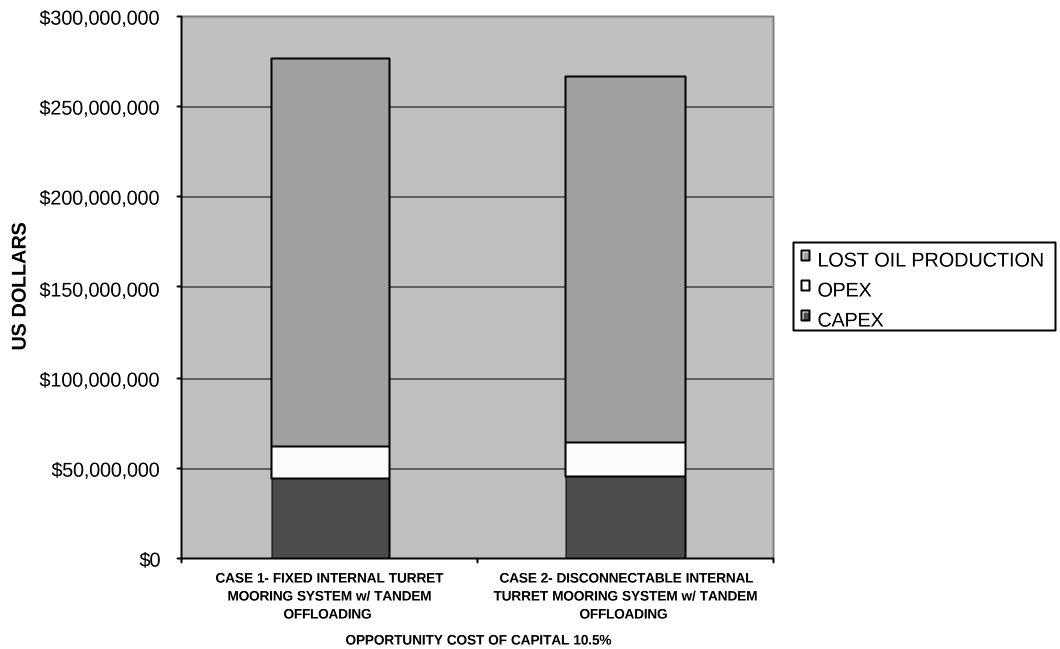

Table 2 - Typhoons South China Sea Area

1959 TO 2001 - 42 YEARS

Year	Month	Typhoon	Maximum Wind Speed Knots
1959	AUGUST	IRIS	90
	AUGUST	JOAN	170
	AUGUST	LOUISE	125
	DECEMBER	GILDA	150
	DECEMBER	HARRIET	125
1960	APRIL	KAREN	75
	JUNE	MARY	75
	JUNE	OLIVE	125
	JULY	SHIRLEY	125
	OCTOBER	KIT	90
	OCTOBER	LOLA	80
1961	MAY	ALICE	65
	MAY	BETTY	100
	JUNE	CORA	80
	JULY	ELSIE	100
	AUGUST	JUNE	110
	AUGUST	LORNA	150
	AUGUST	ELAINE	175
	SEPTEMBER	OLGA	75
	SEPTEMBER	PAMELA	170
	SEPTEMBER	SALLY	60
1962	MAY	HOPE	85
	MAY	IRIS	65
	JULY	KATE	85
	JULY	OPEL	150
	AUGUST	PATSY	65
	AUGUST	WANDA	95
	SEPTEMBER	CARLA	75
	SEPTEMBER	DINAH	100
	NOVEMBER	JEAN	90
	NOVEMBER	LUCY	100
1963	JUNE	TRIX	70
	JULY	WENDY	135
	JULY	AGNES	85
	JULY	CARMEN	125
	SEPTEMBER	FAYE	110
	SEPTEMBER	GLORIA	90
	DECEMBER	PHYLLIS	75
1964	MAY	VIOLA	70
	MAY	WINNIE	100
	JULY	ELSIE	100
	AUGUST	IDA	135
	SEPTEMBER	RUBY	120
	SEPTEMBER	SALLY	170
	SEPTEMBER	TILDA	110
	SEPTEMBER	VIOLET	75
	OCTOBER	CLARA	80
	OCTOBER	DOT	90
	NOVEMBER	IRIS	65
	NOVEMBER	JOAN	70
	NOVEMBER	KATE	90
1965	MAY	BABE	80
	JULY	FREDA	140
	JULY	HARRIET	100
	AUGUST	MARY	150
	SEPTEMBER	ROSE	100
1966	MAY	IRMA	120
	JULY	MAMIE	85
	JULY	ORA	85
	AUGUST	SUSAN	80
	SEPTEMBER	ELSIE	115
	DECEMBER	PAMELA	90
1967	MARCH	SALLY	85
	APRIL	VIOLET	120
	JUNE	ANITA	80
	AUGUST	KATE	70
	AUGUST	NORA	70
	OCTOBER	CARLA	160
	NOVEMBER	EMMA	140
1968	AUGUST	SHIRLEY	65
	AUGUST	WENDY	140
	AUGUST	BESS	65
	SEPTEMBER	ELAINE	150
	NOVEMBER	MAMIE	65
	NOVEMBER	NINA	70
1969	JULY	TESS	70
	JULY	VIOLA	130
	AUGUST	DORIS	65
	SEPTEMBER	ELSIE	150
1970	SEPTEMBER	GEORGIA	140
	OCTOBER	IRIS	100
	OCTOBER	JOAN	150
	OCTOBER	KATE	130
	NOVEMBER	PATSY	135
1971	APRIL	WANDA	75
	MAY	DINAH	90
	JUNE	FREDA	65
	JUNE	GILDA	90
	JULY	HARRIET	125
	JULY	JEAN	85
	JULY	LUCY	130
	JULY	NADINE	150
	AUGUST	ROSE	120
	SEPTEMBER	AGNES	75
	SEPTEMBER	DELLA	70
	OCTOBER	HESTER	90
1972	JUNE	ORA	80
	JULY	SUSAN	65
	AUGUST	CORA	65
	SEPTEMBER	FLOSSIE	75
	SEPTEMBER	LORNA	75
	OCTOBER	PAMELA	110
	NOVEMBER	SALLY	80
	DECEMBER	THERESE	105
1973	JULY	ANITA	70
	JULY	DOT	85
	AUGUST	GEORGIA	70
	SEPTEMBER	LOUISE	75
	SEPTEMBER	MARGE	80
	SEPTEMBER	NORA	160
	OCTOBER	OPAL	75
	OCTOBER	PATSY	140
	OCTOBER	RUTH	90
1974	JUNE	DINAH	70
	JULY	IVY	95
	OCTOBER	BESS	65
	OCTOBER	CARMEN	75
	OCTOBER	DELLA	90
	OCTOBER	ELAINE	95
	NOVEMBER	GLORIA	120
	NOVEMBER	IRMA	115
1975	JANUARY	LOLA	70
	JULY	NINA	135
	SEPTEMBER	ALICE	75
	SEPTEMBER	BETTY	95
	OCTOBER	ELSIE	135
	OCTOBER	FLOSSIE	70
1976	JUNE	RUBY	120
	AUGUST	BILLIE	125
	SEPTEMBER	IRIS	75
1977	JULY	SARAH	75
	JULY	THELMA	85
	JULY	VERA	110
	SEPTEMBER	DINAH	75
1978	APRIL	OLIVE	85
	AUGUST	ELAINE	65
	SEPTEMBER	LOLA	75
	OCTOBER	RITA	155
1979	JULY	ELLIS	85
	AUGUST	HOPE	130
	SEPTEMBER	MAC	70
	OCTOBER	SARAH	110
	NOVEMBER	VERA	140
1980	JULY	JOE	105
	JULY	KIM	130
	AUGUST	NORRIS	90
	SEPTEMBER	RUTH	65
	SEPTEMBER	PERCY	125
1981	JUNE	KELLY	75
	SEPTEMBER	CLARA	120
	NOVEMBER	HAZEN	100
	DECEMBER	LEE	95
1982	MARCH	NELSON	105
	JULY	ANDY	120
	AUGUST	DOT	80
	SEPTEMBER	IRVING	90
	OCTOBER	NANCY	115
1983	JULY	TIP	65
	JULY	VERA	90
	JULY	WAYNE	135
	AUGUST	ELLEN	125
	OCTOBER	JOE	65
	OCTOBER	LEX	70
	NOVEMBER	PERCY	70
1984	AUGUST	IKE	125
	OCTOBER	WARREN	65
	NOVEMBER	AGNES	120
1985	JUNE	HAL	100
	SEPTEMBER	TESS	75
	SEPTEMBER	ANDY	85
	OCTOBER	CECIL	100
	OCTOBER	DOT	150
1986	JUNE	PEGGY	140
	AUGUST	WAYNE	90
	OCTOBER	ELLEN	60
1987	AUGUST	BETTY	140
	AUGUST	CARY	85
	SEPTEMBER	GERALD	105
	OCTOBER	LYNN	140
	NOVEMBER	NINA	145
	DECEMBER	PHYLLIS	100
1988	MAY	SUSAN	75
	JULY	WARREN	115
	OCTOBER	PAT	75
	OCTOBER	RUBY	125
	NOVEMBER	SKIP	125
	NOVEMBER	TESS	65
1989	MAY	BRENDA	75
	MAY	CECIL	75
	JUNE	DOT	100
	JULY	GORDON	140
	OCTOBER	ANGELA	130
	OCTOBER	BRIAN	80
	OCTOBER	DAN	70
	OCTOBER	ELSIE	140
	NOVEMBER	HUNT	90
1990	MAY	MARIAN	90
	JUNE	PERCY	115
	AUGUST	YANCY	90
	AUGUST	BECKY	90
	SEPTEMBER	DOT	80
	SEPTEMBER	ED	90
	NOVEMBER	MIKE	150
1991	JULY	ZEKE	80
	JULY	AMY	125
	JULY	BRENDAN	70
	AUGUST	FRED	95
1992	JUNE	CHUCK	80
	JULY	ELI	75
	JULY	GARY	65
	AUGUST	OMAR	130
	NOVEMBER	FOREST	125
1993	JUNE	KORYN	130
	JULY	LEWIS	85
	AUGUST	TASHA	80
	SEPTEMBER	ABE	110
	SEPTEMBER	BECKY	65
	SEPTEMBER	DOT	80
	OCTOBER	IRA	120
	NOVEMBER	KYLE	95
	NOVEMBER	LOLA	105
	DECEMBER	MAUNY	120
	DECEMBER	NELL	65
1994	MARCH	OWEN	75
	JULY	TIM	125
	AUGUST	GLADY	105
	OCTOBER	TERESA	80
	DECEMBER	AXEL	115
1995	JULY	GARY	65
	AUGUST	HELEN	70
	AUGUST	KENT	130
	AUGUST	LOIS	65
	SEPTEMBER	RYAN	130
	SEPTEMBER	SIBYL	95
	OCTOBER	TED	70
	OCTOBER	YVETTE	65
	OCTOBER	ZACK	95
	OCTOBER	ANGELA	155
1996	JULY	FRANKIE	90
	JULY	GLORIA	90
	JULY	HERB	140
	AUGUST	NIKI	95
	SEPTEMBER	SALLY	140
	SEPTEMBER	WILLIE	65
	OCTOBER	BETH	90
1997	JULY	VICTOR	65
	AUGUST	AMBER	110
	SEPTEMBER	FRITZ	75
	OCTOBER	LINDA	65
1998	AUGUST	OTTO	100
	OCTOBER	BABS	135
	DECEMBER	FAITH	90
1999	APRIL	LEO	110
	JUNE	MAGGIE	105
	AUGUST	SAM	75
	SEPTEMBER	YORK	70
	OCTOBER	DAN	110
2000	JULY	KA-TAK	75
	AUGUST	BILIS	140
	SEPTEMBER	WUKONG	95
	OCTOBER	XANGSANE	90
	OCTOBER	BEBINCA	85
2001	JUNE	CHEBI	100
	JUNE	DURIAN	75
	JUNE	UTOR	80
	JULY	YUTU	85
	JULY	TORAJI	100
	SEPTEMBER	NARI	100
	SEPTEMBER	LEKIMA	95
	NOVEMBER	LINGLING	115
	DECEMBER	VAMEI	75