FPSO/FSO - CONVERSION VS. NEW BUILD

BY

Scott C. McClure and Alan C. McClure

ABSTRACT

The decision whether to construct a new barge or to convert an existing trading tanker for use as a floating production/storage unit is based on three key factors: the cost and time to convert an existing vessel versus the new build, and the required life on station. Many other technological aspects influence the decision as well. This paper presents the major areas of concern in this decision making process and identifies potential benefits and risks associated with the respective decisions.

INTRODUCTION

The only reasons for considering a used tanker are savings in cost and time. The relatively small cost difference that often occurs between the new build and the conversion may be attributed in part to the fact that extensive repairs may be needed, coatings are more costly, and extensive upgrades of machinery and systems may be required to meet the expected life on station. Some high cost items are also included in both options, for example the meter/prover and water curtain system. However, converting an existing tanker usually requires less time than building a new barge.

Five major considerations directly affect the cost and time of the conversion. These considerations are startup time frame, field life, environment, regulatory environment, and tanker charter market at the particular point in time. Questions particular to the installation in question will impact the attention given to each of these five broad areas. This paper discusses each of these areas, and addresses their impact on the cost and startup time.

STARTUP TIME FRAME

Reducing the time between development drilling and first oil reduces the financing costs associated with development of a field. The field development design process often times uses up much of the available lead time before production must commence. This puts the FPSO/FSO on a "fast track". The time to produce first oil may be shortened if a suitable existing tanker can be located. Finding a suitable tanker requires a tradeoff study of the various attributes of vessels available at the time. These tradeoff studies typically review essential characteristics such as storage capacity and age, as well as auxiliary power, maintenance history, structural design, date available and of course purchase price. Tankers must be surveyed and estimates made as to how much of the existing equipment may be refurbished or new equipment is needed. The actual cost for conversion cannot be estimated before very detailed ship specific inspections have been carried out. The conversion time may be reduced if less equipment needs to be refurbished. The vessel general condition will be somewhat reflected in the purchase price.

Designing and constructing a new build FSO/FPSO may take two years and sometimes longer depending on the availability of shipyard space. Shipyard construction slots are a finite quantity, but in recent times this has not been a particular problem. This may change in coming years, however, with the advent of the requirement of double hulls for tankers and with the resurgent interest in construction of LNG tankers. Conversions require about one year, and conversion berths are more plentiful.

THE SOCIETY OF NAVAL ARCHITECTS
AND MARINE ENGINEERS
FPSO TECHNOLOGY SYMPOSIUM; 1993

FIELD LIFE

The length of time the unit is expected to remain on station greatly influences the decision on whether to choose the new build or conversion option. If the field is expected to produce for more than about fifteen years, a converted tanker is not likely to have enough life remaining in the primary structure. The primary structure must be evaluated from a corrosion as well as fatigue standpoint. The first item directly affects global strength characteristics while the second addresses the useful life remaining in the structure.

A major difference between an FSO/FPSO and a trading tanker is that the FSO/FPSO will be expected to remain on station for the duration of the field life. Trading tankers are routinely drydocked and structural repairs and other maintenance are carried out. It is preferable not to remove the FSO/FPSO for drydocking and maintenance because this would necessitate replacement with a temporary unit. In the case of an FPSO this is not an option at all, while for an FSO it may be considered but only after about ten years and this would partially depend on the remaining life of the field. Production from a field may be jeopardized or seriously impacted if the wells are shut in. This impact on the reservoir must be taken into account with a temporarily disconnectable unit. In this case the unit is disconnected to reduce the extreme environmental loads on the mooring system and tanker, but only for a very short time. Typically this would be only a few days at a time. The time required to take the unit to a shipyard for maintenance is much greater than a few days. Revenue is zero while the field is shut down in either case.

ENVIRONMENT

The environment in which the unit will be used has a major impact on the question of new-build versus conversion. A decision must be made whether to remain on-site under all conditions or to disconnect and run to avoid the extreme load cases.

If the unit is to be used in the Gulf of Mexico, and it is designed to remain onsite during hurricanes, then the structure must have much greater strength than say that for the South Natuna Sea or the Red Sea. The structure must withstand the maximum expected loads as well as the fatigue damage inducing loads over the long term. Trading tankers are designed to skirt major storms and as such their scantlings may not be adequate to withstand extreme storms. This is particularly the case for a converted tanker that is already ten years old with some corrosion and possible cracking due to fatigue. Studies have been carried out for the Gulf of Mexico which found that recently built tankers may not withstand a 100 year hurricane storm condition. Tankers are typically built very close to the rule scantlings, and in more recent times higher strength steel has been used for the majority of the structure.

One approach around this limitation is to use a larger tanker than is required from a capacity standpoint and to dejumboize it by removing a portion of the parallel midbody. This approach uses the larger cross section with a correspondingly larger section modulus over a shorter length. Older tankers built of mild steel and to more conservative rules make better candidates for conversion if they have been well maintained.

If, on the other hand the environmental conditions are mild, then a converted tanker may be entirely adequate from a structural standpoint. This is actually the case in most of the existing FSO/FPSO units in use today.

REGULATORY ENVIRONMENT

The regulatory environment of the North Sea is quite different than most other regions of the world with the possible exception of the Alaskan Arctic waters.

The North Sea region has much stricter design guidelines than most other areas of the world. Retrofitting tankers to meet these regulations may be difficult and expensive compared to new construction. Building an FPSO for the North Sea will be subject to many of the same requirements of fixed production platforms with regard to personnel safety. This may necessitate redesign of the entire deckhouse and other systems.

CONSTRUCTION MATERIAL

Tankers built before about 1975 were constructed primarily of mild steel. After this time many ships were constructed of high strength steel. The fatigue properties of this material are not as good as mild steel. At the same time, corrosion allowances were reduced or eliminated based on improved coating systems. Trading tankers are generally designed to be maintained in a shipyard on a routine basis such that fatigue cracks or structural failures may be repaired. It is not uncommon for a tanker to enter a shipyard and require a week of crack repair work to be carried out. Coating systems may be maintained as well.

This is not the case of an FSO/FPSO. The structure must withstand long term exposure to stresses. Fatigue studies must be carried out for the conversion and new build as well. The tanker survey for an existing ship should determine the type of steel used, whether a corrosion allowance was included in the design, the quality of the coating system, and the structural details. The maintenance of the structure, coating system and structural details should also be obtained for review. Reviewing the classification records may provide some insight to the maintenance history of the vessel.

CHARTER MARKET

Tanker usage fluctuates over the years. In the early 1980's there were many large tankers laid up which had not seen much service. These were prime candidates for conversion. As the world oil market changed, the need for more tankers increased and by the late 1980's most of these tankers had either been used for other projects or were actively trading. This has the effect of driving up the purchase price of used tankers. The world economics has also had an effect on the overall quality of the tanker fleet. Many tankers are still operating but with less maintenance so that more refurbishment is required to bring the vessel up to the standards required for an FSO/FPSO.

CONCLUSIONS

The tradeoff between new build and conversion reduces to time and cost. Selection of a suitable tanker takes into account the life on station requirements. Table I, Summary of Estimated Costs For a 1,000,000 bbl FSO, presents a comparison between a new build barge and a converted tanker. The table shows a range of costs for each item as appropriate. Tanker purchase prices may vary between $8,000,000 and 16,000,000. The difference between the new build and conversion may not be very great after the purchase cost of the tanker is added in. The conversion cost of the tanker will bear some relationship to the purchase price, but will also depend greatly on the other factors described previously. The high and low costs shown in Table I do not necessarily coincide with the high and low purchase price.

Since the cost may not be much lower for a conversion, it really comes down to a question of time. Can the conversion be brought onstream faster than a new build and still meet the field life requirements? The answer would likely not be the same at different times in history.

TABLE I
SUMMARY OF COST ESTIMATE FOR ONE MILLION bbl FSO UNIT

		NEW CONSTRUCTION		CONVERSION	
		LOW	HIGH	LOW	HIGH
		(U.S. $ x 1000)			
1.	GENERAL Pre-purchase inspections			20	40
2.	STRUCTURAL HULL	17000	20000	0	400
	Mooring System Fnd	100	200	150	250
3.	DECK HOUSE Helideck Water Curtain Insulation & Linings Fire Protection	800	900	500	600
4.	HULL FITTINGS Hatches, Deck Foundations Sea Chests & Underwater Insp. Fittings Boat Landing	400	450	150	250
5.	HULL EQUIPMENT Cranes & Davits Gangway	900	1000	400	480
6.	DECK FITTINGS	230	260	210	320
7.	PIPING-HULL SYSTEMS HVAC Cargo Tank Heating Cargo-Transfer COW Inert Gas System Potable & Sanitary Water	2900	3400	1580	3200
8.	FIRE DETECTION & DISTINGUISHING	125	140	100	510
9.	COATINGS Hull & Tanks Gas Free/Clean Tanks Deck & Accommodations	2200	2460	3600	5100
10.	NAVIATION EQUIPMENT	180	200	130	150
11.	LIFE SAVING EQUIPMENT Boats & handling Life Buoys & Jackets Breathing Apparatus Liferafts & Davits	480	540	480	600
12.	HOTEL EQUIPMENT Commissary Spaces Utility Spaces & Workshops Furnishings Joiner Work	1920	2100	460	540
13.	LOADING COMPUTERS	75	100	75	100
14.	MISC. EQUIP. & STOWAGE	550	620	580	630

		NEW CONSTRUCTION		CONVERSION	
		LOW	HIGH	LOW	HIGH
		(U.S. $ x 1000)			
15.	MACHINERY SYSTEMS Fuel oil Lube Oil Seawater Freshwater Feed & Condensate Steam Generators Ventilation Compressed Air Pumps Emergency Diesel Generator	2430	2700	1420	2260
16.	PROVER/METER SYSTEM	1500	1500	1500	1500
17.	POLLUTION ABATEMENT SYSTEM	260	280	120	180
18.	TANK LEVEL INDICATORS	480	530	430	470
19.	WORKSHOPS, STORES	95	125	50	80
20.	ELECTRICAL SYSTEM Switchgear & Distribution Generators & Auxiliary Motors Lighting	4100	4600	300	775
21.	CENTRALIZED CARGO CONTROL	820	910	230	270
22.	PLANNING AND SCHEDULING	18	20	18	23
23.	TEST AND TRIALS	300	310	280	320
24.	CORROSION PROTECTION	36	40	45	68
25.	DRYDOCKING			350	450
26.	CLASSIFICATION SOCIETY	300	333	100	175
27.	MISC. SHIPYARD SERVICES			500	600
28.	ENGINEERING - Shipyard	500	600	200	400
	SUB-TOTAL	38699	44318	14008	20741
	CONTINGENCY 10%	3870	4432	1401	2074
	ENGINEERING DESIGN SERVICES	480	575	350	450
	CONSTRUCTION SUPERVISION	500	600	400	750
	TOTAL	43549	49925	16159	24015