Adam Smith, Kenny Rogers and the Commerciality of Offshore Technologies

In October 2013 the Annual Ultra Deepwater (UDW) Technology Conference sponsored by Research Partnership to Secure Energy for America (RPSEA) addressed the status of their portfolio of 34 technologies contracted for development assistance through funding from the US Department of Energy. Their objective was to advance key technologies for UDW offshore field development in the US Gulf of Mexico (GoM) and thereby benefit the country's energy situation. Some of these technologies had to do with drilling and riser systems rather than what the SNAME community might see as marine technologies linked to major capital commitments and overall about one in three succeeded in being in some stage of commercialization. This article talks about commercialization of marine technologies - we look at some examples in today's world and see if there is a pattern to it.

When SNAME was founded in the US in 1893, governmental support of new technologies was not the same. On the other side of the Atlantic the UK's counterpart - Royal Institution of Naval Architects (RINA) - traces its roots back to 1860. In between these years the world saw big shifts in marine technologies – from sail to steam assist and full steam powering, hull construction in iron and then steel. The boost to introduce new technologies still often needed a sponsor, usually a risk taking, well heeled businessman - government boosts tended to have more to do with potential benefits to navies.

Adam Smith's influence from 1776

It was further back in time when the fundamental market behavior behind that revolution was identified. It was a professor of philosophy at University of Glasgow who published Wealth of Nations in 1776, a year when the US had other things on its mind! Adam Smith described how society organized to provide goods and services where the provider benefitted and satisfied the needs of groups of others that had a need to buy them, and freely chose to do so. Roughly sixty years later and along the road from where Adam Smith wrote his famous treatise, the technological revolution started in shipbuilding and shipowing, led by Robert Napier and others in the shipyards on Clydeside.

It is obvious today how steel hulls and screw propulsion driven by steam or other technologies were the way to go, but some one back then had to take the business risk in trying it out. Screening out the winners in the commercialization process did not seem any easier then and we may not have got any smarter at it today!

Not all new technologies are created equal

In 2010 RPSEA considered proposals for developing a design for an Extended Well Test (EWT) vessel for UDW use in US GoM. Oil company reservoir guys lobbied for such a vessel, maintaining it could be great for 3-4 months producing testing from reservoirs where reservoir characteristics were not well known, and would be valuable for mitigating high risks on mega investments by reducing uncertainties of prospective field developments in UDW. It was a common operators' dream!

Unfortunately, lining up enough continuous work for such a specialized vessel turned out to be very difficult: aligning with exploration plans and partner decision processes, factors that FPSO contractors had often wrestled with, usually combined with deal killer scope creep! Despite the enthusiasm of technical communities in operators and in the engineering firms anxious to tackle the project, RPSEA decided not to go forward on that proposal. It had been a classic conflict between technology types which collided with hard realities from the business unit types with operators and FPSO contractors who might have to go on the line to invest in such a venture.

Some technologies move more rapidly to commercialization than others. The round FPSO hull design from Sevan was one of the fast ones, conceived in the same year (2001) and same place (Stavanger, Norway) as Remora's HiLoad DP that was being assessed for offloading in UDW GoM by RPSEA. The first round hull FPSO was employed at the *Piranema* development, entering service offshore Brazil in 2007 after a 6-year gestation period. In contrast the HiLoad DP had a gestation period of 12 years before it would also enter service in a special configuration in Brazilian waters later in 2013. Table 1 compares the "Tale of Two Technologies". The pattern of success of one over the other only became obvious as the years passed.

Coincidentally both Sevan and Remora ended up being absorbed into Teekay Offshore Operators (NYSE:TOO) with its shuttle tanker and FPSO interests, in 2011 and 2013 respectively.

Compressed natural gas (CNG) tankers had a seductive story on its simple advantages - for a decade or more the debate had raged on why this would be a needed leap forward in transporting natural gas by sea at near ambient temperatures without the need for expensive cryogenics. Despite many millions of dollars invested by multiple developers and shipping companies worldwide, somehow it never made it to prime time. The technical session at OTC in 2005 that I organized had a standing room only audience, the Coast Guard and shipping companies all debating it. It boiled down in my mind to a simple ratio of the weight of cargo in the CNG tanker divided by total displacement of the loaded tanker. The ratio was way lower than for LNG carriers and crude oil tankers: CNG tankers would be spending too much on moving their own steel weight around. It was unusual to track down a single criterion like this – usually the commercialization question is a number of issues. The promoters could not overcome Adam Smith's "dismal science" of economics and what modern day straw man economic projections

said!

This long experience added to argument that there is a correlation between shorter development times and commercial success – if it is a decade or more, not much chance of making money.

Case history on a new offloading technology considered for UDW GoM

RPSEA contracted a yearlong effort to see if a new offloading technology - HiLoad DP - could be worthwhile for operations in UDW GoM. It is an ingenious new idea for enabling offloading to conventional tankers without the need for the offloading tankers being specially equipped for dynamic positioning and bow loading. It became an intriguing saga with the business sense truly revealed right at the end of the project.

A project team of five contractors, with inputs from ten operators, showed that the HiLoad DP technology could indeed be made to work in UDW in the US GoM.

Then came the economics and commerciality discussion and a different side to it. On the supply side: Tanker availability is made difficult and costly with the existence of the Jones Act that requires US flag, US built, owned and crewed vessels for trade from one US port to another. At the end of 2012 there were 25 "GoM suitable" tankers in the Jones Act fleet that potentially might serve as shuttle tankers, in contrast to 1,054 in the world's fleet of foreign flag tankers that would be "GoM suitable".

On the demand side: Shuttle tanker service for the life of a field may run to several years, conceivably up to the life span of the tankers for certain of the long life reservoirs in UDW GoM.

So there was no easy way to look at the market and say - like in home buying - that the comparables are this or that. An unusual and thin market if ever there was!

Was the addition of the HiLoad DP vessel with its extra CAPEX justified in efficiencies and safety in the economics of the overall offloading spread? Three competitive configurations were considered as shown in Table 2 which projected tariffs in $/bbl for typical delivery of crude oil by shuttle tankers in the GoM from typical UDW locations to typical refinery destinations, for both Jones Act and foreign flag tankers. Calculations showed how the HiLoad DP was the high cost option for both Jones Act and foreign flag tankers if they were ever to be contemplated for US GoM.

In November 2012 the RPSEA project team met with GoM operators and concluded that the outlook for more FPSOs in GoM was limited, probably one more at Shell's *Stones* development

(confirmed in 2013) but could not see any after that, assuming a 10-year outlook. So the basic need for offloading was not good. Attention shifted to the potential for standby applications for pipeline disruption scenarios as seen after the hurricanes of 2005 and for oil spill loading after a *Macondo*-like event. At the end of the project we could not find any industry initiative addressing the pipeline disruption requirement and could not find interest from the two drilling oil spill contractors. We had to face the conclusion that the basic need was just not there, in addidtion to unfavorable economics.

After the last Working Project Group meeting, a chance Googling revealed two previously undisclosed press releases, one for use at OTC in May 2013 and one from February 2013, referring to plans made the previous November for using the HiLoad DP prototype with Petrobras in Brazil under an expected contract, where: (a) the HiLoad DP prototype had been sold by Remora to Teekay at about $34million, (b) subject to satisfactory performance, it would work on a 10-year time charter at around $54k/day, (c) that Teekay had agreed to pay for modification to suit operation in Brazil, bringing the total CAPEX to $55million, and (d) Teekay would provide a tanker as a mother ship, along with the HiLoad DP in the 10-year commitment.

From spending perhaps a $150+million on a prototype down to $34million was some steep discount required to put this HiLoad DP to work! If the only way this device could go to work was at such a discount and for a special situation, why would anyone invest in it for more normal routine offloading requirements?

We had been wasting our time on establishing the feasibility of building a HiLoad DP in a GoM yard, with any hope for commerciality at a $132 million project budget. Now the project's straw man economics plus the observations on the basic need for this technology in UDW GoM all started to fit together!

While HiLoad DP can be made to work in US GoM conditions, it made little business sense to do so. Taking the time to investigate and shining the business sense spotlight made the conclusions clear once the work was done.

It made one stop and wonder whether this intriguing idea could ever find wide use - or if it may go the way of CNG tankers and be destined to fade into history.

Kenny Rogers and making a decision on commerciality of a new technology

The "does it make business sense" discussion can often get messy and complicated. There can be the practical difficulty of telling the parents of what in their eyes is a marvelous creation that they have wasted their time. Rather than that "Parent" metaphor, the "The Gambler" metaphor

is more realistic for the business world in making a decision to invest and go ahead with a new technology - a prudent judgment matter. This is where Kenny Rogers can be worth listening to - you may have heard these words in the chorus of the Gambler:

"You got to know when to hold 'em,
Know when to fold 'em,
Know when to walk away,
Know when to run . . . ."

Divine influence for the winner?

Of the four offshore technologies examined here, only one – the round hull – became commercial. On 24 January 2014, Irving Finkel, curator in charge of cuneiform clay tablets at the British Museum in London, told how a 4000 year old clay tablet contained the story of the Ark and the flood, describing it in his book "The Ark Before Noah", and how Noah's Ark was a round hull. So whether you might say today's round hull pioneers were blessed with divine guidance - or if you say that there really is nothing new in this world - this millenium's pioneers deserve recognition for taking action for commercial success!

Marine Technology:		HiLoad DP Offloading	Round hull for FPSOs & MODUs
Originator of Technology:		Remora	Sevan
Conceived:	Where:	Stavanger	Stavanger
	When:	2001	2001
First unit in production use:		2014 in Brazil	2007 in Brazil
CAPEX in 1st contract		~70% discount	No discount
Time to first use:		12 years	6 years
Acquired by Teekay:		2013	2011
Hulls in service in 2013:		1 in acceptance trials	5 (3 FPSOs, 2 MODUs)
TRL in 2013:		5	7
Subject of RPSEA contract:		10121-4407-01	10121-4404-03

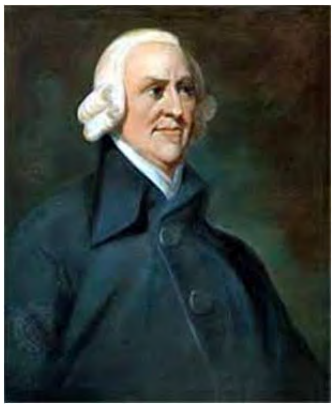
Table 1: A Tale of Two Technologies

Offloading Configuration:	Option 1: Conventional Tanker with Tugs, Floating Hose	Option 2: Enhanced Maneuverability Tanker (CPP, bow thrusters), BLS + Catenary Hose	Option 3: DP2 Shuttle Tanker, no Tugs, BLS + Catenary Hose	Option 4: Conventional Tanker with HiLoad DP, Catenary Hose	Contract Term, years
Indication of Jones Act transportation cost, $/bbl	1.94	1.82	2.12	2.42	16
	1.97	1.85	2.16	2.44	12 to 15
	2.08	1.96	2.30	2.55	10 to 11
	2.52	2.41	2.88	2.95	2 to 9
Use of foreign flag tankers - transportation cost, $/bbl	0.88	0.64	0.73	1.62	16
	0.89	0.65	0.74	1.63	12 to 15
	0.92	0.68	0.79	1.68	10 to 11
	1.05	0.78	0.96	1.85	2 to 9
		Low cost option: used at *Cascade/ Chinook* and later at *Stones*		High cost option: HiLoad estimated $66K/day, 4 man crew, 10 yr TC	

Table 2: "Straw Man" $/bbl Economics for Offloading in UDW GoM, for Jones Act and for Foreign Flag Tankers

Illustration 1: Sources of the Guiding Principles for Commerciality of Offshore Technology

(style as side by side thumbnail images of each, with description below)



Adam Smith, professor of philosophy at University of Glasgow and author of “Wealth of Nations” in 1776

Kenny Rogers, famous for his song "The Gambler", written by Don Schlitz and recorded by the American country music artist in 1978

Illustration 2: HiLoad DP Offloading of Remora Design – Prototype Mobilizing for Test Operations in 2013

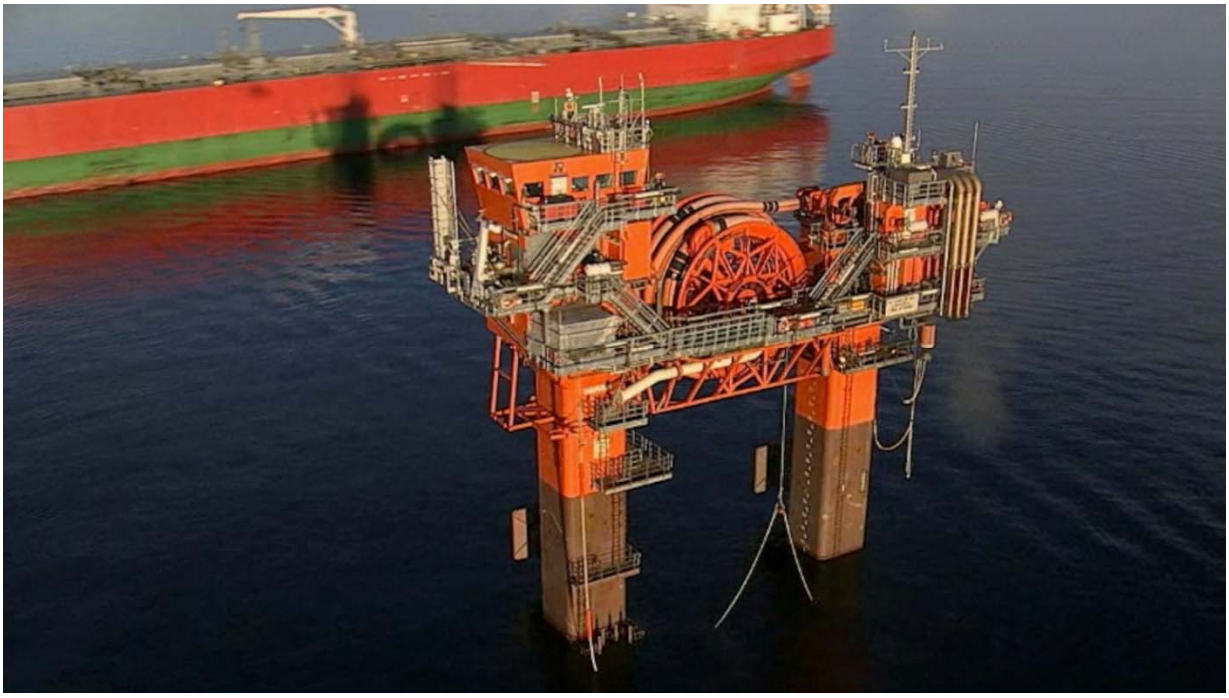


Illustration 3: First Operational Round hull for FPSOs & MODUs of Sevan Design, at Piranema Field Offshore Brazil in 2007

Music

http://www.lovie.org/Media/gambler.php

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About the Author

Peter Lovie is a member of SNAME with a 47 year career in Houston in the offshore and marine world. He was Principal Investigator for RPSEA on the project discussed here. He served as Senior Advisor Floating Systems at Devon Energy, playing key roles in the first FPSO and shuttle tankers for UDW GoM. Previously he was Vice President Business Development at American Shuttle Tankers and before that spent seven years with Bluewater on FPSO project development in North America, active in the early regulatory approval of FPSOs for GoM. The first half of his career was spent on offshore drilling and subsea business. In the last fifteen years has included leadership roles in Rice Global E&C Forum, DeepStar and SPE. He was educated at University of Glasgow (BSc Civil Engineering) and at University of Virginia (Master of Applied Mechanics) where he was a Fulbright Scholar. His interest in the offshore and marine business continues in his current work as an independent consultant.

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