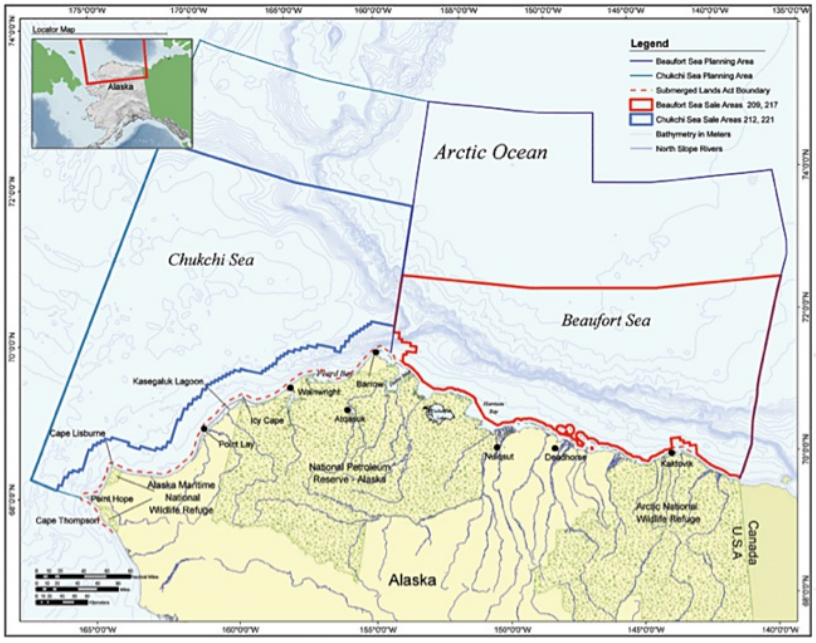
The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Tech Talk - Reaching the Oil: Offshore Alaska

Posted by Heading Out on September 13, 2011 - 3:06am
Topic: Supply/Production
Tags: alaska, alaska government, crude oil production, drill ships, ice island, shell [list all tags]

I have tried in the last two OGPSS posts to show some of the problems that are developing in the flow of oil from Alaska to the rest of the United States. Based on a falling volume of oil produced from the existing fields in the North Slope, the delivery pipeline from Deadhorse to Valdez is approaching levels of flow which will make it more difficult to deliver that oil. There are fields in the region that are still being developed. Alaska_geo has pointed to several developments that are likely to take place over the next year, mainly in exploration but including the development of the Umiat field. One of the mechanisms that the Alaskan Governor has proposed to help encourage industry was to provide a road up to Umiat. The oil reserve for the Umiat field is estimated at 250 mb, but the road may take another five years to finish.

As with the subjects of the last couple of posts not everyone knows where the different places are in Alaska, so since one of the intents with this post is to look at off-shore deposits, let me put up a new map.



Locations along the North Shore of Alaska (USGS).

You will notice that the map shows Deadhorse rather than Prudhoe Bay; this is because that is the official name of the population center. There are a number of possible reasons for the name and I am partial to the one told by Deborah Bernard.

> Once upon a time, a very famous, very rich man in New York set up a $6 million trust fund for his son. The only catch was this son couldn't collect the money until he was 35 years old. The young heir went to Alaska . . . met some people who owned some gravel hauling equipment (and) talked the father into co-signing a loan for this company. . . Things went from bad to worse and he found himself in possession of several dump trucks, pieces of equipment, and a hauling company. He put the heir in charge of it and named it "Deadhorse Haulers." (The) father, disgruntled that he was financially responsible for the ill- fortuned gravel company, said, "I hate to put money into feeding a dead horse." Hence the name.

Which may also be why folk prefer saying that they work at Prudhoe Bay!

The major new exploration, however, will take place offshore, with Shell seeking to send two drilling rigs to the region to drill two wells in the Beaufort Sea and three in the Chukchi Sea, as I mentioned last time. (And I should perhaps have mentioned that of the $4 billion investment Shell is making some $2.1 billion went to the Federal Government in the lease sale). The total oil resource available in these seas has been estimated to be as much as 25 billion harrels of oil (bb) and 127 Tcf of natural gas. Alaska will be selling leases to an area of some 14.7 million acres this fall, though the sale has just been postponed until December.

> It said the acreage involved, covering roughly the size of Massachusetts, Vermont, and Connecticut combined, would include 2 million acres in the Beaufort Sea as well as leases adjacent to the federally-controlled Arctic National Wildlife Refuge and the National Petroleum Reserve-Alaska.

The problems that will be encountered should the fields be this rich are not just limited to those involved in proving the presence of the hydrocarbons through drilling. Production and transportation of the fuel is a non-trivial exercise. Offshore wells will be located in the Arctic where the ice moves subject to wind and current.

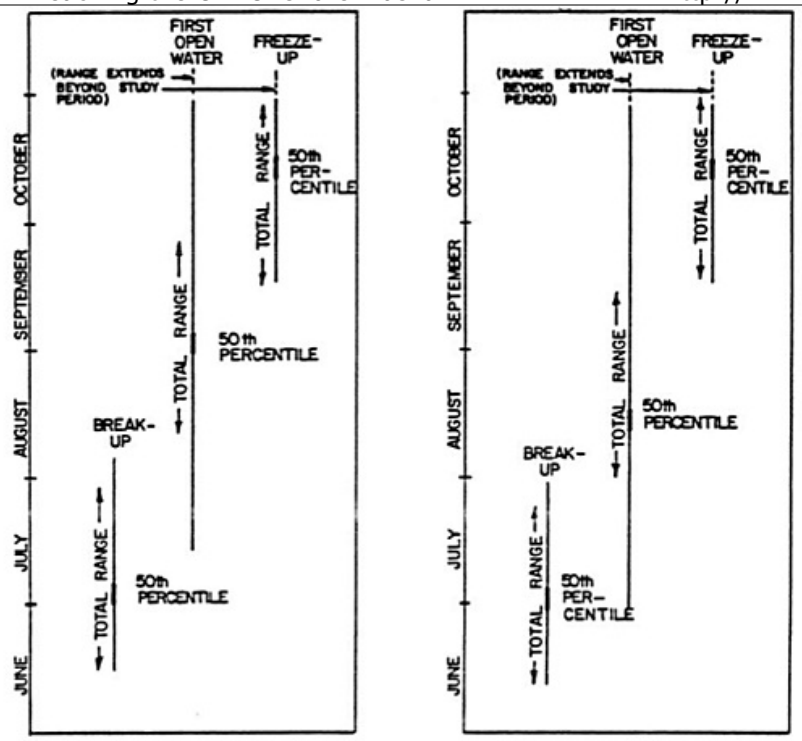
Arctic Ocean circulation (NSIDC)

> sea ice in the Beaufort Sea has more time to grow and reach the thermodynamic equilibrium thickness, so it is thicker. Also, because of the circular rotation of ice in the Beaufort Sea, ice floes frequently bump into each other. Ice deformation is common and leads to thicker and more ridged ice compared to other regions.

Unfortunately, the flow patterns are also not consistent, and may on occasion reverse, thus making the design of systems to survive in those conditions more challenging.

In fact, this the region around the North Pole, from the Beaufort Sea over to the Russian side and fields such as the Shtokman are where the some of the latest technical challenges lie. One problem is that there are not enough US icebreakers, and one of these, the Polar Sea, will be decommissioned at the end of the month while its sister ship, the Polar Star, has been laid up since 2006. There will then be only one remaining, the Healy.

So how does one drill and produce in such an environment? Initially the exploration wells are drilled using drill ships, though these can only operate during the time that the sea is ice free, which varies from year to year.



*Open Water availability Harrison Bay, Alaska (C-Core)**

This limits the time of operation and can be a much more restrictive problem closer inshore and at times when larger and more permanent operations are planned. There is, after all, only so many places you can pull errant icebergs out of the way as the season develops. (The market for hauling icebergs to Arabia never developed). And the problems come in all sizes.

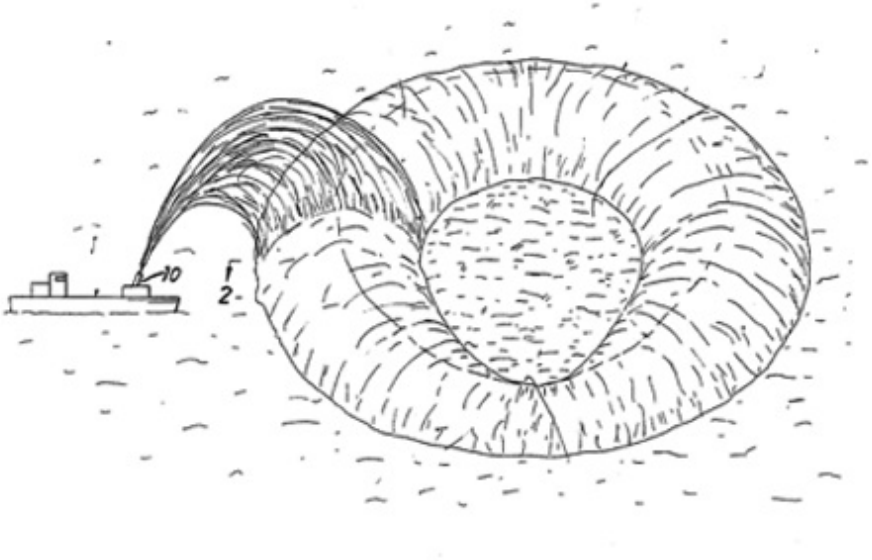
> Support vessels servicing the rigs are also in danger, not from the big bergs, readily visible as they tower from the ocean, but from the small growlers and round-tops, often undetectable on radar and virtually impossible to see in the North Atlantic waves. In some areas, sheer numbers aggravate the problem. The drill ship West Navion had to deal with over 200 bergs and deflect more than seventy while drilling in the Davis Straight.

Towing Iceberg (Hibernia Management and Development)

As a result, ice islands are built that can give more protection to the site, and these can be reinforced with concrete, if needed.(Though it is cheaper just to spray on more water).

The Mars Ice Island off Alaska (BOEMRE)

A number of wells can then be drilled from each island using horizontal drilling techniques to reach out into the reservoir surrounding the island. The islands themselves can be built using a spray technology to build up the ice, since this seems to give a cost advantage* over using gravel or flooded bays to form the structure. The islands can either be build over land or from a floating platform.



Building an ice island (US Patent 4,699,545, 1987)

The Mars Island took 898 hours to construct over 46 days, using over a million cu m of water. This island is 26 ft thick and 700 ft in diameter.

Technologies such as these will allow development of the reservoirs, though it should be remembered that the fuel has to then be brought into some sort of transport system that can move it to processing and future customers. That issue is of even greater concern with the reserves of natural gas found in the Arctic regions, and so I will move on to talk about it next. But for now I will leave you with the thought that even though there may be considerable oil reserves in Alaska that remain untapped at this time, their ability to significantly change the current and near-term global supply in a positive way is realistically almost non-existent.

*Ice Island Study, Final Report MMS Project #468, by C-Core, August 2005