

# Repsol in Alaska: the story behind a big discovery

## Dr. Thomas Buerkert

North America Exploration Manager. Americas Exploration Assets. Repsol E&P USA

### Introduction

At the northern edge of Alaska, in what is known as Alaska's North Slope, Repsol is actively exploring for hydrocarbons in one of the world's most prolific hydrocarbon provinces. The North Slope is home to several monster accumulations including Prudhoe Bay, Kuparuk and Milne Point and has been considered for many years as the exclusive playground for companies like ExxonMobil, BP and ConocoPhillips. Among these mega fields and mega-majors Repsol has been busily exploring for and discovering oil. Together with partners Armstrong Oil & Gas and GMT, over the past winter campaign, Repsol finally proved these discoveries to be material. In May, Repsol and partners announced the largest onshore conventional oil discovery in the United States in over 30 years with the news of success at their Horseshoe well.

The well and subsequent sidetrack proved good quality oil in multiple sand intervals constituting the Nanushuk interval. Furthermore, preliminary data suggests this find is in communication with previous Repsol / Armstrong / GMT discoveries in the same interval more than 20 miles to the north amounting to a single accumulation estima-

ted to hold 1.2 Billion barrels of recoverable oil. This news comes as welcome relief to those at Repsol who have been busy toiling away to demonstrate to the market the justification for re-entering what has been traditionally considered a mature basin. In this brief we will describe the history of Repsol in Alaska, the steps leading up to this discovery and a brief look into what the future holds for Repsol onshore Alaska.

### Repsol's History in Alaska

Repsol has been conducting exploration activities in Alaska since 2007 when it entered into partnership with Shell and Eni for exploration in Alaska's Beaufort Sea. At the time the Joint Venture brought together blocks held individually by Eni and Shell to form a consortium of participants for the purpose of maturing prospects, exploiting synergies and logistics, and reducing exposure for the risky venture of exploring for oil in blocks in Alaska's Outer Continental Shelf (OCS). Shell operated the venture with 40% interest, Eni likewise held 40% and Repsol entered with a 20% working interest. In total the venture included roughly 71 blocks and provided Repsol with a toe-hold for future activity and growth in Alaska.

The US Federal licensing round held for Alaska's Chukchi Sea in 2008 received significant coverage as the "re-opening" of offshore Alaska for major investment. Major bidding activity by Shell, ConocoPhillips, Statoil, and Eni were of note where billions of dollars were committed as lease bonus payments. In this lease sale Repsol took its second step as it continued to grow its Alaska footprint with a significant position in the Chukchi Sea in a secondary play that might have become viable following any success by Shell or ConocoPhillips in their offsetting acreage. While Shell exposed \$2 billion USD, Repsol captured 93 blocks with a combined exposure of \$14M USD. At the commencement of activities Repsol held the third largest acreage position in the Chukchi Sea, just below second place ConocoPhillips.

Eventually Repsol exited both of these offshore positions, with no activity save 3D seismic acquisition over part of the Beaufort Sea leases. With increasing regulatory hurdles for OCS exploration activities, especially following the Deepwater Horizon disaster at the Macondo prospect in the Gulf of Mexico, exploration in Alaska's offshore became increasingly more difficult and expensive.

Our movement away from activity in the Alaska OCS was recently completed with relinquishment of our remaining Beaufort Sea acreage to partners Shell and Eni. Our exit, while not unique – as all players have effectively exited the Chukchi Sea as of now – has been consistent with our new exploration strategy post Talisman.

Prior to exiting the offshore, Repsol continued to expand its position targeting what was viewed to be significant accumulations of bypassed pay onshore. In 2011 Repsol farmed into a partnership as operator with Armstrong Oil and Gas along with their long time partner GMT. The Armstrong consortium held a significant presence onshore in Alaska's North Slope. With this entry Repsol began operating exploration on a land position that was in excess of 600,000 acres, in and around major producing units operated by the likes of ConocoPhillips, Pioneer and Eni. This position eventually grew to roughly 800,000 acres. As Operator our working interest ownership was 70%, and our activities included everything from 3D seismic acquisition through execution of drilling campaigns over four consecutive winter seasons from 2012 through 2015. During those drilling seasons, Repsol successfully drilled 11 exploratory wells and 3 side-tracks. This onshore position continues to be Repsol's.

In November 2015, Repsol, Armstrong and GMT renegotiated the terms of the partnership. These terms included dividing the land position into two areas with two separate working interests. The first is termed the "Development Lands" where Repsol now has a 49% working interest. This area includes the Pikka Unit, which is an exploratory unit that contained most of the previous drilling activity. The second area is termed the "Exploration Lands" where Repsol has a 25% working interest. This year's successful

well, Horseshoe, was drilled on these lands. Under this new partner structure, Repsol no longer operates the exploration activity in our Alaska North Slope acreage although we continue to be active and continue to evolve our position in this truly exciting setting.

### **Repsol Goes Operational and Finds Formula for Success**

Prior to drilling Horseshoe, Repsol as operator drilled 13 exploration and appraisal wells on the North Slope, leading to multiple reservoir discoveries currently included in what has been designated as the Pikka Unit. Drilling activity commenced right away – during the soonest available winter season – following execution of the agreement with the Armstrong consortium. And Repsol's position in Alaska went from Exploration in the office directly into full activity in the field. Over the four operated exploration campaigns, Repsol routinely maintained simultaneous exploration activities at three separate locations. This level of activity brings with it an enormous amount of challenge.

For Exploration activities on Alaska's North Slope the most important challenges are related to logistics in an environmentally sensitive setting. The area where we are active is best described as marshland in a deltaic environment. At this time in our area of activity, there are no permanent roads or infrastructure, although they will be part of any future development. Access and exploration activity can only really occur when the entire area is frozen during long winter periods of harsh sub-zero (F) temperatures. Our business requires construction of temporary ice roads and a great deal of planning to allow us to maximize activity during an operational window of roughly 3 or 4 months. Integrated planning is fundamental

for building the roads and pads, mobilizing the equipment, executing the drilling, and then de-mobilizing the equipment before the temperatures warm and the ice melts. Once the summer arrives, our mandate is to leave no evidence of our activity. And while activity at one location is complex, operating a campaign at three simultaneous locations takes immense talent and teamwork. As the project transitions into development, roads and infrastructure will come in and development pads will be more permanent structures. Even so, planning and logistics will be key ingredients in the mix to ensure safe, environmentally conscious execution under harsh environmental conditions.

In that first winter season, 2011-2012, Repsol was successful, encountering oil in some of the "bypassed" intervals previously seen by historical offsetting wells. However these discoveries were not yet material and were not yet representative of the potential Repsol saw for the region. The game changed however in 2013 when we successfully drilled the Nanushuk formation. This Nanushuk discovery put Repsol and partners at the forefront of a new emerging play on Alaska's North Slope. Although some previous production was known to occur in this interval in offsetting developments, this Nanushuk discovery was the first to demonstrate significant oil accumulation in the interval. Over subsequent drilling seasons the team continued to refine the geologic understanding of the limits of the play - and continued drilling successful wells. By the conclusion of the 2015 drilling season, Repsol had successfully drilled the Nanushuk 5 times acquiring flow tests and core along the way.

Why the Nanushuk? The Nanushuk interval is a conventional sand prone interval in the Cretaceous. This interval is considerably younger and shallower than the previous

Jurassic and Triassic aged targets on the North Slope. Drilling depths for these targets are very manageable and as such allow multiple wells to be drilled from the same pad location within the narrow winter activity window. The sand interval is a deltaic interval with large areal extent over which the quality of the reservoir sands remains high. As has been the experience in the North Slope, large sand containers like the Nanushuk tend to be charged with good oil, and the Repsol venture activities show this to be true in the case of the Nanushuk.

This past year's drilling campaign was focused on testing the extension of Nanushuk interval at the Horseshoe Prospect. The objective of the prospect was to test the extension of the Nanushuk reservoir amplitude trend approximately 20 miles south of Repsol's discoveries in the same interval at the Pikka Unit, where permitting for development activities are underway. The primary geologic risk of the prospect was considered to be reservoir quality and performance.

### **Latest Discovery: Horseshoe**

The Horseshoe-1 well was designed to penetrate an amplitude anomaly, believed to represent the Nanushuk 3 reservoir that tested more than 2,000 & 4,000 BOPD in previous Repsol Qugruk-8 and Qugruk-301 wells respectively, located 20 miles north in the Pikka Unit. Of primary importance in this well was the planned acquisition of ~300' of conventional core through the Nanushuk 3 reservoir, followed by a complete suite of wireline logs including rotary sidewall cores and MDT fluid samples/pressures. Additio-

nal younger, shallower Nanushuk intervals were considered secondary objectives in this well. The Horseshoe-1 wellbore was designed to be slightly deviated (S-shaped <30 degrees max), but vertical in the objective Nanushuk section for optimal coring conditions.

Next, a high angle sidetrack well was planned to penetrate the more western amplitude anomaly. This sidetrack well, the Horseshoe-1A, was designed to penetrate the objective section with LWD logs, pressures and sidewall cores. Traditional wireline logging was not an option due to the high angle (~70 degrees) of this sidetrack. The main objective of the Horseshoe-1A was older Nanushuk sequences, with additional shallower members (including the Nanushuk 3) as secondary targets. Both wells were executed with precision and without safety incident, under budget and with no measurable impact on the environment.

At the conclusion of the campaign, Repsol together with partner Armstrong, had discovered oil in the Nanushuk interval at the Horseshoe 1 and Horseshoe 1ST wells. Both wells found good quality oil in multiple intervals. Prior to this well, Repsol's previous Nanushuk discoveries had all occurred within the Pikka Unit, where the nearest well is roughly 22 miles away from Horseshoe. Initial pressure and oil data indicate that the discovery at Horseshoe is in communication with the wells in the Pikka Unit, suggesting that these Nanushuk units comprise a very large, single container, and finally demonstrate a material project after years of dedicated effort.

### **Repsol's Future in Alaska**

Discovery of a large feature begets a large amount of work, and for Repsol there is no shortage of work to be done in Alaska in the future. In the coming seasons Repsol and partners will continue to appraise and delineate the discoveries in the Nanushuk and will shortly begin to commence construction of the development facilities for portions of the Pikka Unit.

Permitting of part of the project in the Pikka development area, which commenced in 2015, is expected to conclude in 2018. With the delivery of the federal EIS permit, the project will immediately expand to include those activities necessary for the construction of producing facilities: mining for gravel, construction of gravel roads, construction of facilities and pipeline, planning and drilling of production and injection wells at 3 permanent production pads in the Pikka Development Area.

While the portions of the Pikka Unit will move into the development phase, ongoing exploration appraisal activities will commence in the near term at Horseshoe to continue to better understand the distribution of the Nanushuk reservoir and to prove commercial flow through a flow test.

As well, Repsol and partners have other intriguing features in the portfolio to pursue. As the teams continue to mature these prospects in the portfolio, there remains great potential for additional drill wells. And for additional news of big discoveries in the future. ■