
From well to wheels

or the journey of an Azeri oil barrel across land and sea

Tracked by Humay Guliyeva

Here, then, is the story of how that Azeri crude made its journey from the bottom of B05 Central Azeri well in the Caspian to *Herr* Hoermann's fuel tank. It's a tale of immense distances traveled, skepticism and challenges, disappointment and, ultimately, success. The dream of Azeri oil energizing the world is now a reality.

My task was to track a barrel of Azeri crude from oil field to forecourt. I wouldn't have completed this particular journey if it hadn't been for the professionalism and dedication of everyone I encountered along the way.

On the sunny morning of 10th of June, "my" barrel left Central Azeri (CA) reservoir sands and traveled to the surface of well B05. After water and gas had been removed in the platform processing separators, the oil entered a large pump for the first of many pushes towards Ceyhan. Sounds simple I suppose, but the numbers tell a different story: it takes 24 hours for the oil to travel from the reservoir sands to this first pump. The oil, measured in the industry standard of barrels (35 gallons per barrel) leaves the platform via a 30" subsea pipeline to travel 170 kms for over a day under the Caspian Sea to get to the semi-desert industrial idyll of Sangachal Terminal. "We take it for granted now," says CA Offshore Installations Manager Ben Harris. "But it's sobering to think about what happens to the barrels once they leave the platform".

At Sangachal, our particular barrel of oil goes into a large heater to be warmed and then into another separator to allow more water and gas to be removed. It is then pumped into and slowly moves through a large storage tank, allowing any final water and solids to drop to the bottom. Finally, our barrel is now the high quality crude oil, ready for shipping to a refinery. It is pulled out of the storage tank and propelled once again by a smaller booster pump toward the main oil pumps at the BTC pipeline head station. Its brief journey through Sangachal is over. "We know we're a vital link in the chain," says Alan McGuinness, Sangachal Terminal Asset Manager. "It has taken us almost four years to make this part of the process look easy." And so begins the barrel's journey through this now world famous pipeline

Words hardly do justice to the 1770 kms of challenging, rugged terrain and breathtaking landscapes, 2 beautiful Caucasian capitals and ancient Anatolian lands of captivating splendor that our barrel travels through. BTC is more than just a unique engineering ambition; rather its very presence is synonymous with care for both people and the environment, and the sustainable development of the region it encompasses.

And after a month-long journey, the oil finally reaches Ceyhan, a sun-drenched port on the Turkish Mediterranean Coast. Once just the end-of-the-line for a sporadically open pipeline from Iraq's Kirkuk fields, this marine terminal in south-east Turkey has been transformed into a Mediterranean energy hub - and with a planned line from the Black Sea city of Samsun, it is expected to account for 8% of global crude trade at capacity. During its official inauguration on 13th of July, Ceyhan was described by Lord Browne as "the alternative energy corridor that changed the energy map of the world".

Around 400 tankers a year are expected to load at its 2.6 km jetty but for sure, none of those will be as celebrated as *British Hawthorn*. It had the distinction of carrying the first 105,000 tonnes of Azeri light, which is approximately about 770,000 barrels, to Italy. The ship is known as an Aframax, which comes from *Average Freight Rate Assessment* and means that the ship can carry about 70,000-120,000 tonnes of cargo. These are the most flexible ships for BP's crude oil trading - large enough to be economical but not too large to prevent entry to some ports. *British Hawthorn* was built in Japan by Tsuneishi shipbuilders and delivered to BP Shipping in 2003. All BP ships have "British" as their first word and all Tsuneishi-built ships are named after types of tree: British Laurel, British Willow...Oak, Beech, Hazel, Holly, Vine and last but not least the oh-so symbolical Hawthorn. When a new ship is launched, shipping tradition is that a woman names the ship and breaks a bottle of champagne on it. These women are referred to as the ships' sponsors and in BP, senior managers such as Vivienne Cox, Linda Adamany and Anne Quinn or the wives of senior managers have been asked to become sponsors. The *British Hawthorn* was named by Clare, the partner of Peter Bevan who is BP Group's general counsel - the most senior lawyer.

"They that go down to the sea in ships; that do business in great waters; these see the works of the Lord and His wonders in the deep" was an old psalm which was read at naval christenings of Royal Navy ships in the 19th century. On board of *British Hawthorn* I had a chance to meet some of today's seafaring generation.

Alistair Roaf, captain of the *British Hawthorn* seems very young for such an important position. He may look young, but his authority is assured. So when he asks our photographer Steven whether his photo equipment is intrinsically safe and sees an air of hesitation in Steve's look, he doesn't think twice. "Only inside- a view from the captain bridge", he says, his tone soft but firm. Like an offshore platform, safety is paramount on board. The primary role of

the captain is directing the navigation, particularly when the ship is leaving or entering a harbor. He is also in charge of all communications with port agents, and with BP Oil in London through the shipping operator. BP Shipping operates the ships, which BP Oil rents to move the oil. The fleet size and commercial power of BP Shipping is expanding; it will soon have the capability to carry 50% of all BP's cargos.

Chief engineer and proud Scot Doug McLean is the kind of sea salt you would imagine reading Jules Verne's novels as a child. A man with a large stature, his copper-colored face sharply contrasting with long white moustache, he is an endless source of anecdotes, "mostly not publishable", he adds. He started working with BP Shipping in 1969, which was then at the peak of its power with a fleet of 130-135 ships. Visiting Ceyhan has been the most exciting thing Doug has done recently, as they had to paint the entire ship at the drydock in Greece and felt like stars with a "whole squad of television size cameras" on board. A ship is tied to a jetty by wires and as it rises and falls during loading, the deck crew either tightens or releases these wires in sequence to keep the ship in the right position. In Ceyhan, every one of these wires can be released instantly if an accident occurs while discharging. "Very environmentally friendly, because if things were to go wrong there's a very very small amount of oil spill that happens," notes Doug.

The oil trade business has its own peculiar rules. The standard contract for delivering a cargo stipulates that it will be discharged in a 24-hour period. This sometimes means that ships arriving at port are not allowed to notify the port agents until one minute past midnight, what the charters call the layday of the cargo. "So, if we arrive at midnight, we also have to leave at midnight because we say we can do everything in a day - one of the anomalies of this industry we've been trying to change for years," sighs Doug. Luckily, things are different in Italy, the destination of *British Hawthorn*. Most Italian ports operate a daylight berth and unberth policy only, prohibiting ships from sailing during the night. Italian ports are very different from the northern European ones like Rotterdam, UK or Germany where everything is done with a stopwatch. Displaying the same level of professionalism, people are more relaxed and laid back.

Under the Italian sun people are still drunk on the recent triumph of *Squadra Azzurra* in Germany, and a tremendous feeling of pride and celebration is evident everywhere. Trieste, a city and a port located in north eastern Italy right on the border with Slovenia on the Adriatic Sea, is not an exception. But there are more things to Trieste than that. The city flourished as a part of the Austro-Hungarian Empire during the period 1857-1918 when it was Central Europe's most prosperous seaport as well as its capital of literature and music, inspiring James Joyce, Stendhal and young Sigmund Freud.

Our barrel of Azeri light began the next phase of its journey through the Transalpine Pipeline(TAL) from Trieste tank farm located near the village of *San Dorligo della Valle*. TAL is

very similar to BTC- built in 1967, it was the first pipeline ever built across three countries: Italy, Austria and Germany in 1967. It was a dream of the Venetian financier Dr. Marco Barnabo to see Venice once again become the trading metropolis it had been around the time of the Renaissance. He wished to build a highway between Venice and Munich across the Alps, with a pipeline to Bavaria running alongside it.

To pursue this dream Dr. Barnabo financed a number of engineering studies using his own money and presented them to the oil companies and political decision makers. As the proposed route was recognized as technically and financially attractive, the international engineering company Bechtel, which we saw designing BTC 40 years later, was commissioned in 1963 to examine the feasibility and practicability of operating a large transalpine pipeline from the Adriatic to Ingolstadt. Just 4 months later the engineers received the green light, a timetable which those involved in BTC could only dream of.

There were some extraordinary difficulties though. In Italy, for example, the militarized Yugoslavian border was sometimes just a few kilometers away from TAL's route and in the Cold War years, this made securing permission to use the land for non-military purposes difficult. Furthermore, the pipeline crossed several kilometers of the former battlefield of *Isonzo*, the scene of a two-year armed struggle between Italian and Austrian troops during the First World War. The area still contained ammunition remains, not to mention a network of mines. But despite such challenges the pipeline was completed on schedule in June 1967, earning the title of Europe's largest pipeline with a diameter of about 1 meter, crossing some of Western Europe's most beautiful but also geologically most complex regions.

"TAL is a very important source of supply, because we are supplying 75% of the needs of Austria, 100% of Bavaria, 50% of Baden-Wurttemberg and 25% of Czech Republic's need," notes general manager of TAL, Adriano del Prete. "If TAL would not have been built, all these refineries would have to be supplied by oil trucks creating the risk of a high pollution".

The man in charge of the control room, where operators push buttons to send *L'Azeli*, a beautiful sounding abbreviation of Azeri Light in Italian, down the line is Nevio Grillo, TAL Operations Manager. Last year 44% of oil tankers discharging at Bay of Muggia, Trieste, came from the countries of the former Soviet Union, with 7%- 2.5 million tonnes being from Azerbaijan. Azeri light, along with Tenghiz, a Kazakh crude, is a major part of the CPC blend (Caspian Petroleum Consortium). So, after our barrel is stored in a tank in Trieste for a certain period, it is pumped into the mainline and blended with other crudes, forming the aforementioned CPC. On Nevio's table sits a small bottle containing a black greasy substance – this commemorates the one billionth barrel of oil passing through TAL, also from the Caspian.

As I track our oil across the Alps with my companion Stephen Barnett, a UK-based freelance photographer, I come to appreciate the hardships of his profession. Waking up at 6 in the morning to catch the perfect light

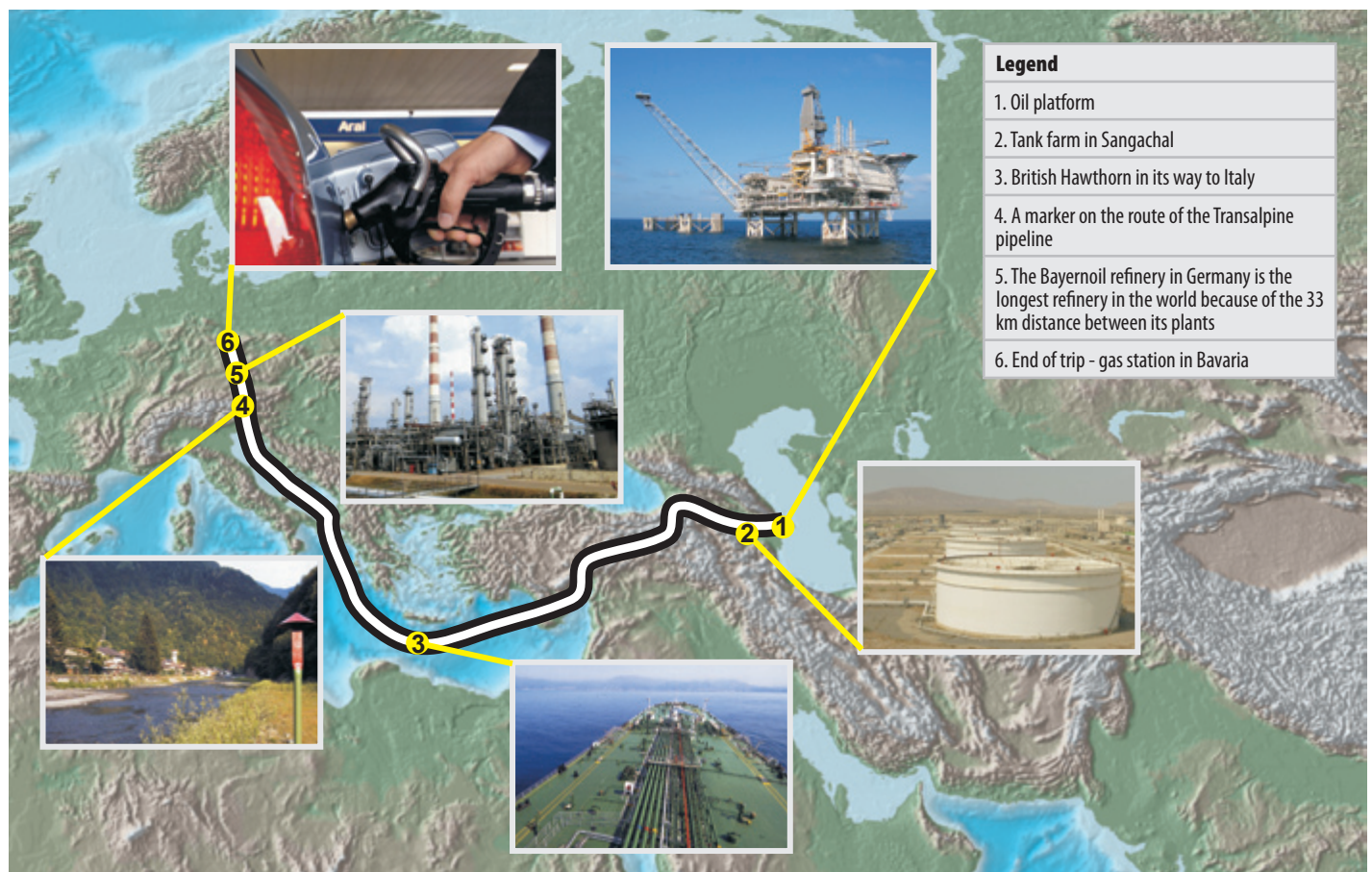
- “you should only photograph when your shadow is longer than you” and hunting a perfect shot for every stunning landscape. Getting very excited each time we saw the signs such as “Attenzione! Oleodotto Transalpino” or “Achtung!TAL-Osterreich Olleitung” along our 460 km long journey, so much so, that, in the end, Stephen refers to them as “our friends”. The landscape, no matter how clichéd it may sound, takes one’s breath away.

As the crude leaves Trieste it travels to the north, passing Udine and the beautiful Lake Cavazzo, through Tolmezzo and Paluzza and then across the Carnic Alps at the Italian-Austrian border through Plocken tunnel. A national border runs through this tunnel, so back at the time of construction, when the tunneling work was complete, the Austrian workers

brought wine with them to toast this success with their Italian colleagues. In a flash, Italian custom officers appeared on the scene with mining helmets and headlamps demanding duties for the wine drunk on the Italian side of the border.

In Austria, TAL first runs across the Gail valley and the Gailberg ridge, then up through the Drau and the Isel valley passing Lienz, a charming medieval Dolomite town located in the Tirol region, during which we were kept awake by a street theatre festival. The next morning we drove up the Tauern stream to Felbertauerntunnel, a place where the pipeline reaches its highest point of 1,572 metres. After crossing the Salzach valley at Mittersill, the pipeline continues across the Thurn pass south-west of Kitzbuhel, a very popular and expensive skiing resort as one can judge from the exclusive

Transalpine pipeline	Baku-Tibilisi-Ceyhan pipeline
Buried along its entire route and passes Italy, Austria and Germany	Buried along its entire route and passes Azerbaijan, Georgia and Turkey
Total length: 735 km	Total length: 1770 km
Seven pump stations: four in Italy, two in Austria, one in Germany	Eight pump stations: two in Azerbaijan, two in Georgia, four in Turkey
Passes 20 major rivers, 154 roads and 26 stretches of railway and five tunnels	Passes over 1 500 river crossings and 13 seismically active fault crossings
Rights of way negotiated with 10 governments, 70 district and 150 local authorities and 6 000 private owners	450 communities and around 100 000 landowners directly affected
1.2 billion euro construction cost	3.9 billion dollar construction cost
Nine refineries and tank farms connected in Trieste, Austria, Bavaria and Baden-Wuerttemberg	Two terminals at Sangachal in Azerbaijan nad Ceyhan in Turkey
40 000 joints of pipe welded, each being 12 meters long and weighting three tonnes	220 000 joints of pipe welded and two million pipelifts



Louis Vitton and Swarovski boutiques in such a small city. At Kufstein our oil reaches the Austrian-German border and, once on Bavarian territory, the pipeline runs through the Inn valley and the west of Rosenheim and Wasserburg towards the north until it reaches the refining center of Ingolstadt.

The Bayernoil refinery is nicknamed "the longest refinery in the world" because of the 33 km distance between its plants at three separate sites: Ingolstadt, Vohburg and Neustadt. Some 12 million tons of crude oil flows through these plants every year, with the crude mainly coming from Russia, Northern and Western Africa and the Near East. Bayernoil refineries produce mostly diesel fuel, gasoline and extra light fuel, used for heating homes. A small percentage of production goes to jet fuel, naphta for the chemical industry, heavy fuel oil (HFO) for industry and power plants, bitumen for road covers and refinery heating fuel. Azeri Light is used in the production of all these products, except bitumen. The first step in processing is called distillation. Subjected to different boiling temperatures, the crude is fractionated its the main components such as gas, crude benzene, gasoil and residue. The straight run gasoline (SRG) with low octane content is enriched and transformed into high octane SRG while the heavy components are processed in the bitumen plant. After the products have been separated, cleaned and

refined they are stored in the component tank farm and from here, the computer controlled inline blenders mix to create an end product. All products delivered are subject to the most rigid internal and external quality assurance checks.

So now, Azeri crude is no more a crude – it is a diesel, a mogas (mobile gas or gasoline), an extra light fuel. It is an "ennobled" product waiting for road tankers to deliver it to a petrol station. In Vohburg, the refinery site I visited, approximately 800 road tankers per day uplift fuel products for delivery to customers, with over 1000 on peak days. One of these, an Aral tanker, left for the Aral retail station in Ingolstadt, SchollstraBe 2. And I followed.

Ingolstadt is the sixth largest city in Bavaria and sits on the banks of the Danube River. And everyone in this city, it seems, drives an Audi. Because this is a place where Audi, yet another symbol of German quality and reliability, was born with Audi being an acronym for "Auto Union Deutschland Ingolstadt". So, "my" car has to be an Audi.

I carried a flag of Azerbaijan in my backpack all the way from Baku-a city of oil legends, where paupers turned to princes overnight with the oil gushes- to fly it above the German car filling up with "my" barrel 5000 kms from where my journey began.

I'd reached my destination...

Co z tą obróbką kamieni*

No cóż, sprawa prosta – odpowiedź zawiera się w jednym słowie – reologia. Słowo raczej zapewne nieznanie Twoim Przyjaciołom – humanistom podziwiającym „precyzję obróbki” bloków skalnych przez starożytnych. Nie ma się co temu dziwić, boć przecież to stosunkowo nowe pojęcie fizyczne. Ponoć przed II wojną, gdy odbywał się pierwszy zjazd reologów gdzieś tam we Włoszech, lokalna prasa informowała o *zjeździe teologów*. Dziennikarze bowiem doszli do wniosku, iż zaszła pomyłka – słowo reolog nie figurowało w żadnym słowniku. Musisz zatem humanistom wyjaśnić to pojęcie „łopatologicznie”. Niech wezmą stalowy drut i powiesz na nim jakiś tam ciężar, tak aby drut odkształcił się w zakresie liniowo-sprężystym, czyli że po odjęciu obciążenia długość drutu będzie równa jego długości przed obciążeniem. Tak będzie się działo gdy obciążenie będzie działało w stosunkowo krótkim okresie czasu. Natomiast jak wykażą się cierpliwością i zdejmą obciążniki z drutu po upływie choćby roku, to okaże się, że odkształcenie drutu jest większe, niż odkształcenie sprężyste. Drut wydłuży się o tzw. odkształcenie trwałe, pomimo wartości obciążenia odpowiadającego tzw. odkształceniom sprężystym. Pod stałym obciążeniem trwałe odkształcenia będą bardzo powoli stale narastać, acz coraz wolniej. Tak też będzie się działo w przypadku starych, masywnych murów i budowli kamiennych. Grawitacja już zażyczy się o to, by już po kilku wiekach szczeliny pomiędzy sąsiednimi masywnymi blokami skalnymi tak zmały,

że trudno pomiędzy nie wcisnąć żyłkę. Ot i cała tajemnica „obróbki kamienia” przez starożytnych. Jak nie wierzą, to proponuje im wycieczkę do Francji czy do „Krainy Deszczowców” Albionem zwanej. We wspaniałych katedrach zachowały się tam jeszcze XII-wieczne witraże. Co ma piernik do wiatraka, a kolorowe szkiełka do reologii? Ano ma. Szkło na witraże wykonano z krzemionki – składnika wielu skał. I co się dzieje? Jak się dobrze przypatrzy, to pięknie barwione kobaltem (najlepiej widać) szkiełka witraży są „kapizdeczkę” jaśniejsze u góry od swoich dolnych części. A dlaczego? – a bo są dołem grubsze, bo się tak z czasem odkształciły. Parę latek temu, akurat jak nas Ciotka Unia wzięła w swe ramiona, urządziliśmy sobie prawie trzytygodniowy objazd po wyspach Krainy Deszczowców (akurat nie lało !!!) pod wodzą naszego naczelnego uczelnianego globtrotera – Jacka Przetockiego (chyba nie ma dziury na świecie, gdzieżby go nie zaniósł). Tamże na własne oczy paru niedowiarków przekonało się o tym zjawisku. No tyle ma temat ciągu dalszego tajemnic starożytnych budowlańców i kamieniarzy.

Pozdrawiam
Jachu Rz.

*) W numerze 2-3/2006 „Rurociągow” ukazał się artykuł wyjaśniający występowanie liczby π „zakodowanej” w starożytnych budowlach. Zgodnie z obietnicą publikujemy rozwiązanie zagadki niezwykle precyzyjnej „obróbki” kamieni.