

Operation Pluto

Chapter One: The essence of victory

Whereas the old adage that an army marches on its stomach held good for innumerable campaigns, in World War II it was firmly established that an army must have sufficient supplies of fuel ^{to} move at all. It was this knowledge that was responsible for the brilliant conception and implementation of the Pluto plan - the laying of a fuel pipeline from Britain to the continent in a single night.

Viewed in the light of today, with large pipelines being laid for hundreds of miles in the depths of the North sea, Operation Pluto may appear with hindsight to have been comparatively simple, with distances of little more than sixty miles, and later twenty miles, to be bridged. But in fact the problems were enormous and complicated by other military requirements. It is doubtful whether it could be done more successfully today, given the same conditions.

In organising the supply of fuel and lubricants to the invading armies the planners were faced with at least three major difficulties. No continental ports or fuel storage installations were likely to be available for some time after the landings; enemy activity would be intense and tankers would be prime targets; and the weather might make landing fuel over the beaches slow or even impossible. In the event enemy activity at sea and in the air was far less than anticipated but nobody was to know that until the assault took place. For a solution to the fuel problem it was natural to turn to the experts in the oil business who daily faced considerable hazards in winning and transporting their product. But the basic Pluto idea came from elsewhere, as will be shown later.

The oil industry had grown enormously between the wars

and techniques had naturally advanced in keeping with the rapid progress. There are few instances of such dash and determination as has gone into the exploration and exploitation of oil and strong nerves are essential in every aspect of the business. It was against this background that Pluto was devised and produced, with magnificent contributions from makers of deep sea cables and steel pipes. But before going into details it will be useful to examine a brief history of the oil situation as it has affected the armed forces of Britain and, to begin with, the Royal Navy in particular.

At the beginning of this century the importance of oil to the Navy in its determined efforts to maintain supremacy at sea had already been realised. As the use of oil [✓]feed ships from the dirt and difficulties of coal firing, giving them higher speeds, longer endurance and therefore greater fighting efficiency, the planners necessarily began to consider sources of supply of suitable oil fuel and the problem of maintaining these supplies in time of war. Since the nearest supplies were in Roumania and others some thousands of miles away the ability of the Navy to control the sea routes can hardly have been questioned. Although stocks of fuel oil could be built up and stored in Britain it was clear that a war could not be fought successfully on the basis of a fixed amount and continued supplies must be ensured, even though the extent of other rapidly growing requirements was not yet obvious.

Today, with oil seeming to flow through everyone's sitting room and Britain only just loosening the grip of the oil sheiks, it is difficult to appreciate that mineral oil only began to be used commercially little more than a hundred years ago and that prior to the invention of the internal combustion engine there was even some question as to how to dispose of it all.

The invention of an improved oil lamp made mineral oil

popular and mineral oil thus rapidly superseded the animal and vegetable oils then in use and brought about one of those instant economic changes in which many businesses suddenly found their product no longer in demand.

The new lamp oil was known by the producers as kerosene but in Britain it became known as paraffin and for a considerable period this was practically the only use made of mineral oil. Then another change took place with the introduction of gas lighting and for a time it looked as if mineral oil was going to be superseded in the same way as vegetable and animal oils. But it was not long before it was found that oil, as well as coal, could be used to produce gas for lighting and although coal remained the major raw material, oil had its advantages and was widely used for special purposes. Paraffin was still used extensively for cooking and heating, particularly in districts not served by gas and indeed still is today.

Although the internal combustion engine and the increased use of motor cars led to a steadily expanding market for petroleum products the growth was not particularly fast. In Britain, the use of oil as a furnace fuel was naturally restricted by the abundance of coal. Even so, oil had considerable advantages as a fuel. For its weight it had a much higher calorific value than coal, is easier to control in a furnace and is much easier to transport. In ships it was found that the advantages of oil fuel were such that they far outweighed the lower cost of coal and by the outbreak of World War I in 1914 both the Royal Navy and the merchant shipping companies were turning steadily from solid to liquid fuel. The Navy commenced trials with oil burning vessels in 1901 and a (continued overleaf)

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battleship designed to run on oil fuel was laid down in 1912. The oil age was really beginning to get into its stride.

As the volume of oil increased the problems of transportation of the product grew too. The early shipments of oil from the United States to Britain were in wooden barrels - the barrel is still the unit of volume* - and metal cans but this became uneconomical for large quantities. Thus the bulk carrying ship, known as a tanker for obvious reasons, came into being and oil in bulk first crossed the Atlantic in 1886. This in turn led to the necessity for storage tanks at ports and other terminals. All this involved special development and new techniques and the knowledge required led to the oil companies having to deal with all aspects of their product from the well to the customer, unlike other industries which tend to concentrate their activities. Because of this and because of the huge investment involved the oil companies rapidly grew bigger and extended their empires to wherever oil was discovered. This in any case was usually in countries ill-equipped financially and technically to exploit their own resources.

To the Royal Navy in particular, as the only service at that time really interested in oil, this situation had a number of unfavourable aspects. Apart from a process discovered in 1847 for distilling oil from shale, of which there are considerable quantities in Britain, no indigenous oil was available in the country. This meant that in war time the fleet would depend entirely on foreign supplies and even with control of the seas this had obvious disadvantages. From the beginning of the present century the British government began to take steps to improve the oil (next page)

* The standard ^{U.S.} oil 'barrel' contains 35 imperial gallons and 42 U.S. gallons - about 8 barrels to the tonne.

situation. First by discouraging or actively preventing any foreign exploitation of oil in any countries under British control and by proposing similar action in the self-governing Dominions. Next, by legislation requiring that where oil concessions were granted, the companies operating them should be substantially British manned and directed. In addition arrangements were made to ensure the production of suitable oil fuels for the Navy and the right to take over facilities in war time.

Further, Britain herself began to initiate or support prospecting for oil on her own account and in 1901 enabled a Mr William D'Arcy to obtain a licence to search for oil in Persia. Various other enterprises were set in train, including exploration for oil in Turkish territory and in Iraq, the rights being negotiated by Mr Calouste Gulbenkian.

The increasing use of oil and the clear necessity of providing for the oil fired ships in the building programme and the security of supplies in war time was causing the Admiralty some concern. First a select committee and later a Royal Commission under Admiral Fisher was set up to consider the means of storage and supply of liquid fuel in peace and war. The result was a series of reports, then confidential, which emphasised the importance of long term supply and proliferation of sources.

With its very considerable influence in the Middle East it is perhaps surprising that the British government did not take a more positive part in the development of oil resources known to exist. In fact, in typical diplomatic fashion it would appear to have hovered undecidedly on the fringe. Later by taking the unprecedented step of giving financial support to the Anglo-Persian Oil Company

in exchange for a controlling interest it became responsible for a big expansion of British owned oil resources. Shortly after the Anglo-Persian deal was concluded the company obtained a 50% holding in the Turkish Petroleum Company which had negotiated a lease of the petroleum resources of Mosul and Baghdad.

So at the start of World War I in August 1914 the supply of oil for the Navy, and indeed for all purposes in Britain, was reasonably well secured, providing the Navy kept the sea lanes open. Up to this time the bulk of oil fuel used by the Navy had come from Rumania and an alternative was clearly necessary. The most obvious answer was to buy from America but the discovery of oil in Trinidad in the West Indies was particularly valuable as it was of a type most suited for use in naval vessels and which gave them an appreciable increase in speed as compared with other fuel oils.

Britain came through World War I without suffering any major shortage of oil in spite of the massive shipping losses due to U-boat sinkings in the North Atlantic and elsewhere. The concentrated efforts generated by the necessities of war led to considerable advances in many branches of engineering including the internal combustion engine and particularly of diesel engines which were already being used to power large vessels. The Royal Navy was now almost entirely committed to oil fuel and even to a country blessed with an abundance of coal, oil had such attractive advantages that the British government continued energetically to try and further the certainty of oil supplies both in peace and war. These efforts met with some success but were hampered by earlier agreements and in fact the monopoly of Middle East oil which seemed so near achievement at the

outbreak of war in 1914 had slipped through Britain's grasp. But by the outbreak of war in 1939 the British holdings in the Middle East were producing impressive quantities of crude oil and a refinery had been built on Abadan island in the Persian gulf capable of supplying almost the entire needs of the Royal Navy - providing of course that the fuel could be transported to where it was required. However, the total output of oil throughout the British Empire was only 2% of the world output.

In addition to overseas sources the possibility of oil being found in Britain in appreciable quantities was explored and one or two small fields discovered. Of more importance was the fact that the closed door policy which prevented foreign companies prospecting for oil in British controlled territory was ended. The restrictions had had some unfortunate consequences as such limitations tend to do and had certainly cut down the amount of oil actually available. Other methods of obtaining oil were also explored and oil from shale was produced successfully - an Admiralty contract for the supply of 30,000 tons a year being obtained by the producers. The amount involved, however, was not large enough to be of significant value in time of war.

Oil from coal was a different proposition and though expensive, had the possibilities of this source of supply been fully appreciated at the time it was considered, the massive expenditure on the necessary plants might well have paid handsome dividends later, as well as giving the coal industry a welcome boost. Indeed, Germany, being in a similar position to Britain with regard to oil supplies, did build plants using two different processes to produce oil from coal and by 1939 was obtaining a large part of her oil requirements in this way. The main objections to the system

in Britain were probably two; one, the increased cost of oil so produced was approximately 7d (3p) a gallon from shale and 10d (4p) a gallon from coal, as compared with 4½d (2p) a gallon for imported petrol; the other objection was that the huge plants required for the processes of obtaining petrol from coal would be very vulnerable to air attack and far more likely to be put out of action than numbers of ships bringing individual cargoes from overseas. Economically it was suggested that it would be much cheaper to pay the dole than to expend the huge sums necessary to construct hydrogenation plants to keep the men employed! There would appear to be some muddled thinking somewhere.

When war was declared in September 1939 this was the general situation with regard to oil supplies. Britain had quite a large amount of oil under her control and there was plenty available elsewhere. All that was necessary was to transport the fuel to this country. With German U-boats making their presence felt early in the war and raiders at large attacking the sea routes, there must have been some second thoughts on the security of oil supplies, as indeed there were for supplies in general. Living on an island has its disadvantages.

The progress of war at sea followed what must, or at least should, have been an anticipated pattern. There was no phoney war at sea and the German U-boat fleet built up a formidable list of sinkings to which were added the victims of the wide ranging raiders like the Graf Spee and also ^{those of} the magnetic mine. The resources of the Royal Navy were stretched to the limit and even the most perfervid opponent of rearmament must have had doubt about the wisdom of his cause. Gradually more escort vessels became available and aircraft made a welcome contribution to the methods of sinking or

at least discouraging U-boats. Even so large numbers of ships and thousands of lives were lost and tanker casualties sometimes involved crews in a horrifying holocaust. The tanker sinkings were watched with growing concern by those responsible for oil supplies and every effort was made to improve imports by using vessels to the best advantage. This was often complicated by the necessities of the convoy system which meant ships waiting at assembly points and taking longer routes to avoid U-boat concentrations. Between December 1939 and February 1940 the tanker losses amounted to 150,000 DW tons with 67,000 tons damaged; but with the collapse of France and with U-boats operating from her west coast sinkings increased. A tenth of all available tanker tonnage had been sunk by the end of 1940. 1,000

There had been some difference of opinion between the allies on the use of available tankers and France, with a refining capacity of 8,000,000 tons a year needed 11,500,000 tons of crude oil to achieve this. Much less tanker tonnage was needed to produce the same results if refined products were imported. The fall of France together with the Low countries and Norway and Denmark made nearly a million tons of additional tanker tonnage available to Britain. This was a welcome addition but bought at a very high price.

When the oil reached Britain the discharge and storage could and did pose a number of difficult problems. It was decided that the minimum use should be made of the east coast ports because of their vulnerability to air attack and the increased dangers of the sea routes and approaches. This also applied to the south coast, and Fawley on Southampton Water, one of the most important oil terminals, could not be used for ocean going vessels for the same reason. The outcome of these restrictions was that much greater use had

to be made of west coast ports. Here congestion occurred principally owing to the difficulties of dealing with much greater quantities of oil than normal, which produced storage and internal movement problems. In fact, these problems actually led to a decrease in the amount of oil handled by west coast ports, rather than an increase. Coastal tankers were moving smaller tonnages than originally estimated owing to demands on the fleet by the armed services.

area / Added to the difficulties of handling the oil was the ever present problem of financing the payments for oil purchases from American companies. Even oil from the sterling had some dollar component, such as payment for royalties or American materials and equipment. Towards the end of 1940, drawing oil only from sterling sources became a possibility, owing to the much improved tanker situation. A tentative approach was made to the American oil companies to gauge their reaction to a special import duty on American oil. The result was that the American companies were sympathetic but strongly opposed to any discrimination against them, which is hardly surprising. Further, the US Treasury made it plain that any attempt to deal with payments for oil on a different basis from other materials might have unpleasant consequences. Since beggars cannot be choosers these British efforts to conserve dollars ended there. It seems strange that Britain did not just cut down her imports of American oil without bothering about a special duty but there would appear to be some other reason for not doing so.

With an inflammable commodity like oil stored in large quantities in normally easily identified places the vulnerability of installations to air attack was given

a great deal of thought by those responsible. The erection of bunds, or retaining walls round individual storage tanks and also round groups of tanks proved capable of confining fires to a considerable extent although, as expected, many raids were directed solely at oil installations. In spite of these concentrated air attacks, up to the time air raids virtually ceased the oil losses were far less than the planners anticipated and hardly affected the overall situation at all. As will be seen, in the case of Operation Pluto vulnerability of tankers and oil installations to air attack were again overestimated but this time for a different reason. Indeed, it would seem that in some instances there must have been some doubt as to whether the results of air attack justified the lives and efforts expended on them.

Another possibility exercised the minds of the authorities and this was that oil storage installations might fall into the hands of a force invading Britain, for an invasion was a distinct threat for some time. In France, large stocks of fuel fell to the advancing German forces, without which their progress must have been much slower. In Britain an invading army would be even more grateful for local supplies, including those as small as provided by a filling station. As a result, some 17,000 filling stations and petrol stores were closed down in the east and south-east of Britain and special arrangements were made for the defence or destruction of large installations.

The difficulties experienced in the movement of oil once landed in Britain have been mentioned. A major portion of this work was undertaken by railways but rail tanks are of comparatively small capacity and involved considerable amount of work in loading, marshalling and unloading. There were other complexities and large quantities of the

oil required to supply London and the home counties frequently put a strain on the resources.

In 1941 the possibility of moving the oil through cross-country pipelines was given careful consideration and several routes suggested. Eventually it was decided to build a pipeline from Avonmouth on the Bristol channel to Walton-on-Thames, west of London, where new storage was built. From Walton-on-Thames the oil went by river barge to the London oil depots, instead of up river from the estuary depots as previously. This pipeline made a big difference to inland oil movements and its success led to proposals for an extension of the idea. The first proposal was to connect Avonmouth storage to that of another oil port and after some consideration it was decided to connect Avonmouth with Stanlow, on the Manchester Ship Canal. This north-south line involved laying pipes over a distance of 150 miles but it allowed useful flexibility in the working of the two major west coast ports. The line was completed in June 1942 together with a branch from the Avonmouth-Walton line which was connected to a large storage complex at Aldermaston in Berkshire and then on to the big Fawley refinery on Southampton Water. Fawley was also joined by an underwater pipeline to another refinery at Hamble on the other side of Southampton Water.

At this point the question of supplies of fuel for the re-entry to the continent was already receiving attention and the experience of previous campaigns naturally affected the deliberations of the planners.

Although comparatively easy, but dangerous, to transport petrol in the standard four gallon cans - known as 'packed' supplies - had many disadvantages. The cans were easily damaged and leakage losses were high; as much as 30% in some

cases. Added to this, a large dump could go up in flames from a variety of causes and leaky cans could turn a ship into an enormous bomb. So when in North Africa a large number of German petrol containers - jerricans as they were soon known - were captured, it was at once realised that here was a very much better method of packing petrol for transportation on land for mobile forces. The difficulty was that the jerricans had to be manufactured and the plants and and built/machinery designed/from scratch. This made it clear that sufficient jerricans for both American and British forces would not be available by the projected date of the invasion. Also, the use of jerricans called for bulk supplies from which they could be refilled and ^{as} it was unlikely that the enemy would leave any oil installations intact provision had to be made for this.

The planners therefore had to provide for means of getting bulk petrol and other oil products ashore after the initial assault, in which pre-filled jerricans would be used. It was certain that no ports would be left in a condition to be used by tankers and it was considered essential to have some means of getting fuel ashore in bulk over the beaches. In any case, between Le Havre and Antwerp there were no ports suitable for ocean tankers and Cherbourg was not a main oil port and had little storage capacity.

The first proposal for landing bulk supplies of fuel was a reversal of the method used to load oil from many of the installations abroad. This consisted of a pipeline laid from the shore out under the sea to a tanker berth in deep water. Certainly it appeared reasonable to suppose that if this method could be used to load vessels it could also be used to discharge them. Although comparatively simple to do in peaceful surroundings and without urgency, for the

invasion the provision of similar facilities off a hostile shore, with the enemy in close proximity, posed a number of problems not met with previously. Under the instructions of the Chief of Combined Operations, then Rear-Admiral Lord Louis Mountbatten, a series of experiments and trials were carried out, of which more details are given in a following chapter. But there was a serious shortage of both large and small coastal tankers and it was anticipated that these vessels would suffer severely at the hands of the enemy. To remedy this situation the Americans built a large number of 600 ton vessels they called 'Y' tankers and Britain put in hand thirty 400 ton ships known as 'Chants', which could carry either bulk or packed fuel. Many more Chants were considered necessary for the operation but only another nine were built leaving a possible gap in the fuel supply which obviously caused the planners some concern.

Meanwhile the cross-country pipelines in Britain had been extended considerably and a line constructed linking Misterton in Yorkshire with Stanlow, primarily to serve the east coast airfields. From Misterton the line was laid to Sandy, Bedfordshire, and to Hethersett in Norfolk, Saffron Walden in Suffolk and thence to Shell Haven in the Thames estuary. Also the Avonmouth-Walton line was extended to the Isle of Grain and, with the invasion clearly in mind, on to Dungeness in Kent. Of this last depot we shall hear a good deal more in due course.

This, then, is the brief history and general situation governing the essential supply of fuel to the invading forces as Britain and America addressed themselves with great determination, energy and ingenuity to the re-entry to the continent of Europe and the defeat of Nazi Germany.