THE BUILD-UP AND THE ALLIED NAVIES

The landing in Northwest Europe being the largest amphibious operation ever undertaken, the problem of supply to the armies on the far shore entailed an organization of unprecedented magnitude and complexity. I have already indicated the obstacles which face«l my logistical planning staff during the months of preparatory effort. There was a struggle to acquire the necessary shipping and landing craft, a struggle to collect the requisite tugs, a struggle against time to prepare the novel devices, such as the various elements of the artificial harbors upon which we so greatly relied; eventually there was the herculean pre-D-day task of assembling the vast armada in the ports of southern England in such a manner that it might be loaded and sailed to schedule and yet achieve the seemingly impossible in escaping the attention of the enemy. Events were to show the success with which these and many other difficulties were overcome. I must also acknowledge the work of my Chief Administrative Officer, General Gale, of whose abilities I had received full evidence during the campaign in North Africa and Italy, but whose achievements in that theater were dwarfed by his accomplishments in the invasion and liberation of Northwest Europe.

When the anxieties of D-day were over, the burden of responsibility of those in charge of our logistical services was in no way lightened. Some problems might be solved by experience, but new ones were ever arising. The smooth running of the shuttle service across the Channel, the efficient transfer of supplies to the armies over the beaches and through the ports, the protection of the supply routes, and safeguarding of the packed anchorages as the build-up progressed, remained the responsibility of the Allied Naval Commander, Admiral Ramsay. His untimely death on 2 January 1945 was a great loss to the Allied cause. The handling of the large number of varied craft employed was a most praiseworthy feat on the part of Admiral Ramsay and the Task Force Commanders responsible for the execution of his orders. Over 5,000 ships and craft were employed in the actual assault, and in addition over 2,000 Allied merchantmen, with an aggregate displacement of some 4,000,000 tons, had to be prepared and fitted into the complex plan of the subsequent build-up. These merchant ships presented a peculiarly delicate problem, as the 70,000 men who sailed them were not under direct naval discipline. Nevertheless, their crews surrendered many of the age-old privileges of the sailor in their willingness to become part of the great invasion machine, and during the months following D-day they served the cause with consistent courage and devotion to duty.

The lightness of our losses at sea and in the anchorages compared with the number of ships involved is the best measure of the success with which the Allied navies kept the seas and held the enemy at bay from the invasion area. Behind this success lay in part the experience gained in the expedition to North Africa in 1942, but off France, operating in much more difficult waters, the problems facing them were often new and always far more complex than those encountered earlier. In this operation we staked our all in many respects upon unknown factors, and to the skill with which the navies met the unexpected our initial victory was largely due. New enemy defense devices and weather of unprecedented foulness even for the capricious English Channel alike failed to overcome this ingenuity and determination. Such adverse factors might prevent our supply from attaining the theoretical maximum, but from D-plus-2 onward, except for the great storm later in June, there was never any real danger of our maintenance failing, and the armies never went short of food for men or ammunition for guns. On 1 July the Chief Administrative Officer was able to report that the commanders in the field had complete freedom of action as far as supply arrangements were concerned.

By D-plus-5 we had in the main successfully overcome the initial struggle to get the beachheads organized. We had cleared the enemy from all the beaches; the Allies had linked up along the whole of the invasion coastline; the first units of the artificial harbors were in position and the build-up forged ahead steadily. The enemy was still in a position to bring gunfire to hear upon the beaches and anchorages on either flank; his coastal forces were massing at Cherbourg and Le Havre to prey upon the approaches; and his aircraft were nightly engaged in laying mines. It was, moreover, not only with the human antagonist that our navies and mercantile marines had to contend. The weather during June, 1944 was the worst experienced for that

month during the present century. The gales which had threatened us with disaster on D-day itself continued to hamper our operations throughout subsequent weeks, culminating in the great storm of 19-22 June, the effects of which were so serious as to imperil our very foothold upon the Continent. After the gales came the fogs of July, which once more held up the cross-Channel shuttle services. Through all this the perseverance of the seamen kept the armies in the field.

The principal handicap to the build-up after D-day sprang from the shortage of landing and ferry craft following the serious losses among the mines and obstacles during the assault. Also, apart from the invaluable dukws, many of the minor landing craft proved too lightly built for continuous service in waters as rough as we experienced, and this was particularly true of. the rhino ferries, the serviceability of which rarely rose over 50 percent. Another major worry arose from the losses we suffered in motor transport ships from mechanical defects and enemy action.

To overcome these difficulties we were compelled to resort to "drying out" LST's and coasters on the beaches. Such a process had previously been thought too dangerous to attempt, but having been adopted as a desperate expedient on D-plus-1, it proved so successful as to be continued as a regular practice. The only drawback was a slower turn-around and consequent tendency for shipping to accumulate off the far shore.

By thus profiting from the lessons of experience, the Allied navies and mercantile marines were able to land over 500,000 men by D-plus-9, and the millionth man stepped ashore in France on D-plus-28. Apart from the personnel landed, a million tons of stores and nearly 300,000 vehicles were put ashore by D-plus-38. At the end of August, when the German armies were in flight eastward beyond the Seine, but while we were still basically dependent for our build-up on the beaches, Cherbourg, and the artificial harbors, the Allied armies under my command exceeded 2 million men. For, them over 3 million tons of stores had been brought across the Channel, together with over 400,000 vehicles.

Thus, despite the trials of wind and weather and the persistent attacks of an ingenious enemy, the necessary rate of reinforcement to our land forces was maintained. Our build-up outstripped that of the Germans, deceived as they were by our latent threat to the Pas-de-Calais and hampered by our air attacks upon their communications. A great part of the men and supplies were landed over the beaches by the splendid effort of naval and engineer personnel who handled this difficult operation. Despite the delays occasioned by unfavorable weather, the rate of discharge over the beaches was maintained at a high level. At Omaha beach, for example, the daily average of supplies unloaded from D-day to 30 September was 10,000 tons, the daily rate reaching nearly 12,000 tons for the critical period of July and August. At the smaller Utah beach, the daily average from D-day through September was 5,000 tons, and during this period upward of 750,000 men debarked at this one point. Since Cherbourg did not begin to function in volume until August, and only approached a 10,000-ton daily average in September, the importance of the beaches to our supply is easy to appreciate.

Another factor of importance was the novel expedient upon which we staked much of our chances of success, the artificial harbors. Although our plan of operations called for the seizure of Cherbourg at an early date, we realized that the Germans might leave the port in such a condition as to preclude its full use for many weeks following its capture. The Mulberry artificial harbors were judged essential to ensure the discharge of cargo, under conditions that would be relatively independent of weather during the crucial early stages of the campaign. When the time came for the execution of the scheme, the Mulberries were subjected to strains of a severity far greater than we had believed likely. Nevertheless, although the American harbor had eventually to be written off as a total loss, the British Mulberry, which suffered less, was repaired and continued to function. It was of tremendous aid to our operations during the summer.

In the months of continued experiment and feverish constructional activity following the Quebec Conference in August 1943, when the outline of the harbor project was approved, the Mulberry scheme occasioned me and my staff many a headache. Some of the prototype units evolved promptly sank when tried out at sea (although their models had behaved excellently in the storms of experimental tanks); labor difficulties caused hold-ups in construction, and securing the necessary tug allocations was in doubt up to the last moment. Confusion, moreover, was occasioned by the division of responsibility between the Admiralty, the War Office, and the British Ministry of Supply. The Minister of Labor performed the miracle of raising the necessary workmen from a labor-exhausted Britain, however, and the construction of the

huge concrete caissons in pits beside the rivers, into which on completion they were floated by breaching the retaining banks, was typical of the ingenuity and resource by which difficulties were met and overcome. Not least of our anxieties was the fear that the enemy should learn of our intentions, particularly in view of the large amount of casual labor which had to be employed, but events proved that the secret was well kept, a remarkable achievement considering the thousands of men and women who had a hand in the work of construction. Indeed, so complete was the ignorance of the enemy as to our intentions, and so lacking was he in air reconnaissance when the plans were being put into effect, that it was not until mid-July, when the scheme was practically completed, that he realized the existence and purpose of the Mulberry. Then he failed to appreciate its true significance, assuming it to be an improvised measure forced upon us by the extent of his demolitions at Cherbourg and the ravages of the storms.

Under the final scheme, five sheltered anchorages, known as Gooseberries, where landing craft could operate when an on-shore wind might otherwise hamper their unloading, were to be constructed with sunken blockships, one Gooseberry to each of the five assault beaches. Two of these anchorages were subsequently to be expanded into complete Mulberry harbors, each the size of Dover and costing some $100,000,000. A Mulberry was to consist of a breakwater of sunken blockships, supplemented with sunken concrete caissons, each 200 feet long, known as Phoenix. Within the shelter thus provided, LST's and coasters could discharge their cargoes on to floating Whale piers, so constructed that at low tide they would rest firmly on the rocky foreshore. Seven miles of pier, with 15 pier-heads, were planned. Outside the ring of Phoenix caissons and Corncob blockships was to be a further floating breakwater of 200-foot steel Bombardon units, designed to provide a sheltered anchorage for Liberty ships, within which they might transfer their cargoes to ferry craft. The enclosed area at each Mulberry was to extend some two miles in length and one mile in width. In all, 400 units, totalling 1,500,000 tons, had to be towed across the Channel, and 160 tugs were required to make 35 heavy tows daily in order to complete the installation by the target date of D-plus-18.

The accurate and successful planting of the Mulberry units represented a triumph of skill for the two navies respectively responsible for the installations off the American and British beaches. The sinking of the Gooseberry blockships began on D-plus-1, and by the following day the first Mulberry tows, which had set out on the morning of D-day, had arrived off the French shores. The installation of the harbors in acutely congested waters, under enemy action, during the early stages of our whole gigantic enterprise was a task of extreme complexity, but it was expeditiously and accurately carried out, and in the course of the two weeks following 6 June the ports rapidly took shape. By the morning of D-plus-5 the blockship breakwaters in both harbors were completed, and all the Gooseberries were in full use except that at Utah beach, work on which had been hindered by enemy gunfire. By D-plus-10 all the Gooseberries were completed and the Mulberries 50 percent so. The towing of the huge, cumbersome caissons and the sections of piers and pierheads was considerably hampered by the continued bad weather, and nearly a third of the Whale units was lost in transit through this cause. By 19 June, however, lengths of pier were already in use; the Mulberries as a whole were about 90 percent completed, and over 2,000 tons of stores a day were being handled in the British harbor alone.

On that day, 19 June, broke the great storm which at one time seemed certain to bring all our work to disaster. The weather had been unsettled since D-day, but the on-shore gale which now blew up was the worst known in June for 40 years past. The Mulberries took the full force of the mountainous seas driven by the gale, and the situation was all the worse since the storm had not been expected and no forecasts of it were received. All unloading, except for a few ammunition and fuel cargoes which were taken off by intrepid dukw crews, had to be suspended, and shipping in the congested anchorages was soon in difficulties. The storm continued for 4 days. During that time, tows caught in passage were lost, and craft and ships off the beaches dragged their anchors and were dashed ashore. To add to our troubles, the enemy's new Oyster mines were activated by the movement of the waters and caused further casualties. By 21 June the Mulberries themselves began to disintegrate, particularly the United States installation, which was in an even more exposed position off St-Laurent than the British one at Arromanches. The Bombardons of the outer breakwaters broke adrift and sank; the Phoenix caissons shifted; and the angry seas poured through the gaps, pounding the ferry craft against the piers and smashing them to

pieces. Only the blockships saved the situation from becoming one of completed disaster.

During 22 June the fury of the gale gradually abated, but the seas continued to run high and hinder the work of salvage. After the Mulberries had been so near completion and the beach organization had got into its stride, it was appalling to contemplate the damage wrought by the gale. Despite the gallant efforts of the tug crews and other personnel to save the shipping, efforts which cost them heavy loss of life, some 800 craft were stranded on the beaches, and the greater part of these suffered damage. Wreckage was strewn over the sands along the whole invasion coastline. Some 600 craft were eventually refloated on the 8 July spring tides and a further 100 a fortnight later, but the resulting shortage of ferry craft was a serious blow which hampered us throughout the summer.

Of the Mulberries themselves, that at St-Laurent was so shattered as to be irreparable. Due to the scour and sea action, the main Phoenix breakwater at St-Laurent was broken and the blockships had sunk some 10 to 12 feet below their original level. At Arromanches the Phoenix breakwater could be made good, at least temporarily, and the line of blockships had held. The great value of these latter was such that on 23 June, while the seas still ran high, 4,500 tons of much needed supplies were unloaded under the shelter still afforded. The outer Bombardon breakwaters were completely wrecked and had to be abandoned at both anchorages.

On 26 June it was decided that in view of the damage sustained the original plan for the St-Laurent Mulberry would have to be abandoned, although the remaining blockships could be strengthened to provide a shallow anchorage for barges and small craft. The Arromanches Mulberry, having suffered less, could be repaired and completed; moreover, by decking in the caissons and making other modifications, it was thought that it could be made to last until October or possibly longer. Salvaged material from St-Laurent was available to complete the three damaged piers. This scheme for the rehabilitation and winterization of the Arromanches harbor was approved and the work was at once commenced.

In the accomplishment of the work, I was given loyal and effective help by the British authorities, although the difficulties facing them were legion. The supply of labor was a particularly serious problem at a time when the repair of V-bombed houses in London drew heavily upon the resources. United States general service troops and naval construction personnel were made available to assist in this respect. By great efforts and sacrifices on the part of all concerned, the work was accomplished. Although the winterization modifications had yet to be finished, the harbor was virtually completed and the storm damage repaired by 20 July. At the end of that month nearly 4,000 men, over 400 vehicles, and over 11,000 tons of supplies were disembarked within its shelter during a single period of 24 hours. Throughout the summer and autumn the achievements of the Mulberry exceeded our best hopes, for, although the planned rate of supply discharge was 6,000 tons a day, the actual average, from 20 June to 1 September, was 6,765 tons.

The course of our military fortunes was to make the utmost demands upon the means upon which we were so completely dependent for supply. Although by September we had defeated the enemy decisively in Normandy, he knowing our necessities, clung obstinately to the western ports of St-Nazaire and Lorient, as well as to the Quiberon Bay area (which we had planned to develop into a major harbor), while demolishing the installations at Cherbourg and Brest so thoroughly that it required many weeks' work before they could be restored to full capacity. Under these circumstances the open beaches and the Mulberry continued to be the main channels of supply to our armies during the period when their drive eastward across France forced logistical demands to a peak. It was not until Antwerp had been. captured and the Scheldt made safe for our shipping that the beach installations and the Mulberry became superfluous. Throughout the summer of 1944 they represented an essential factor in the success of our operations. Without them our armies could not have been adequately maintained in the field, and the men who worked them with so much gallantry and devotion deserve the gratitude of liberated Europe for their share in our victory.

Of the natural ports which fell into our hands before the opening of Antwerp, only Cherbourg, third biggest port of France, had a capacity that would appreciably lighten our supply problems. The small harbors along the Norman coast, such as Ouistreham, Courseulles, and Port-en-Bessin, had their value, particularly during the early days of the campaign, but their capacities were small, and the same was true of Granville, St-Malo, Morlaix, and the other harbors uncovered by our subsequent drive south through the Cotentin and into Brittany. Brest, when it eventually fell to us after stubborn resistance,

was so fully destroyed that, in view of its remoteness from the main battle front, it was considered useless to attempt any major rehabilitation.

Cherbourg, however, represented a cardinal factor in our basic logistical plans. The sea and airborne landings in the Cotentin, as has been shown, had been expressly designed to facilitate its early capture so that we might use its valuable harbor as an all-weather base through which to introduce supplies. The enemy, on the other hand, fully appreciated the importance to us of an early seizure of Cherbourg, and when his attempt to defend the city failed he undertook, with typical Teutonic thoroughness, the task of rendering the harbor unusable.

Cherbourg's commander surrendered on 26 June, and the U. S. Port Clearance party began the work of tidying-up on the following day, although nests of resistance among the dockyards were yet unsubdued and the guns of the breakwater forts prevented mine sweeping. While certain major facilities survived, such as the breakwaters enclosing the great anchorage and some of the drydocks, the extent of the enemy demolitions presented a formidable task to the clearance personnel. Seventy-five percent of the cranes had been destroyed, over a dozen vessels had been sunk to block the dock entrances, and quantities of every kind of mine had been sown. Such equipment as was not destroyed had been immobilized by the removal of vital parts and the skilled labor had been evacuated.

The task of mine sweeping was fraught with difficulties and dangers, even when the forts had been reduced, but by 19 July the port came into use and unloading began. At first the disembarkation of stores was mainly by dukws, but through the summer work on the harbor installations went on at a feverish pace. By the end of August, Cherbourg was handling an average of over 10,000 tons a day, and by the beginning of October, when the work of reconstruction was completed, its capacity was as great as, if not greater than, had been the case before the war.

The cross-Channel supply of fuel for our armies in Operation OVERLORD constituted a special problem. Although the lines of communication over which the fuel had to be brought, from the United Kingdom to the battle front, were not as long as those to North Africa, the rate of consumption was far higher. During the assault phase we had naturally to rely upon canned gasoline, but by 3 July bulk supply was being introduced by ship-to-shore pipe line from tankers to storage dumps, thus affording a considerable saving of time and tonnage. For the period when the armies had attained the strength to enable them to break out from their lodgement area and sweep across France, however, as well as for the later stages of the campaign against Germany, novel devices were employed, the experimental character of which was second in daring only to the artificial harbors project.

The scheme, developed jointly under naval and military auspices, was known by the name of PLUTO. In order to save shipping, to increase the rate of supply, and to prevent interference with the armies' maintenance by bad weather, submarine pipe lines were to be laid across the Channel. The pipes were of two types — the Hais and the Hamel, each of which was 3 inches in diameter and expected to discharge 250 tons of gasoline a day. The first lines were planned from the Isle of Wight to the vicinity of Cherbourg — a distance of 56 miles. It was hoped to have ten lines operative by D-plus-75, giving 2,500 tons of gasoline daily.

As was to be expected with so experimental a scheme, many obstacles were encountered. The laying of the lines was a hazardous process, and the storms of June and July repeatedly interrupted the work. The first Hais line was completed by 12 August, and a second by the 21st, but leaks and stoppages resulted in further delay before either line could be operated, bad weather preventing clearance work. Subsequently, however, these teething troubles were overcome and further lines were laid over the shorter route from Dungeness to Boulogne. These provided our main supplies of fuel during the winter and spring campaigns.

For the protection of our cross-Channel shipping routes and hence for the successful maintenance of the armies in France we were dependent upon the ceaseless work of the Allied Navies, assisted by RAF Coastal Command. These kept constant watch, to such good effect that the shipping losses which we sustained due to direct enemy action were extremely small in proportion to the vast tonnage involved.

The enemy concentrated his main efforts against the beaches and anchorages. From landward, although our penetrations soon insured the freedom of the central beaches from artillery fire, the flank ones remained objects of attack. The reduction of the Cotentin Peninsula removed this menace on the west, but Sword beach — the easternmost of the British sector — continued to be exposed to enemy shelling as well as to attacks by E-boats, explosive motorboats, and human torpedoes based in the Seine area. The

resultant losses were considerably greater than those in other sectors, and, after restrictions had been repeatedly imposed for these reasons, the decision was taken on 13 July to abandon the beach permanently for unloading purposes.

To counter the menace of enemy shelling and to afford support to our troops advancing inland, the navies carried out many heavy bombardments of the enemy batteries, defensive positions, communications, and supply dumps. On the eastern flank the configuration of the ground made observation difficult, but the armies were warm in their praise of the support given to them by the heavy naval guns. The characteristic ingenuity of the Navy was seen in the device of rocking the ships to raise the angle of the guns so that they might engage targets beyond normal range; and the effectiveness of the firing was seen when the capture of the strongly casemated battery at Houlgate (which had been primarily responsible for the shelling of Sword beach) revealed that three out of its four guns had sustained direct hits. The ships intervened vigorously in the battles ashore, both to break up enemy concentrations for counter-attacks and to supplement the barrages preparatory to our own advances, and this intervention was continued until the breakthrough came at the end of July and the enemy retired eastward.

During the early stages of the campaign the enemy made some daylight attacks upon the anchorages with bomber and fighter-bomber planes, but these proved very ineffective and were soon abandoned. Night raiding (sometimes in conjunction with surface craft attacks), continued and caused casualties. We found in this connection that, although naval antiaircraft fire was good, fire discipline was not easy to enforce among the large and diverse fleet of merchant shipping assembled for the build-up. Blind firing without orders resulted in the loss of some friendly planes, and eventually the Allied Naval Commander was forced to prohibit all-night antiaircraft fire by merchant ships.

Although both bombs and torpedoes were dropped by the night raiders, their chief effort was devoted to minelaying, supplementing the activities in this respect of the surface craft based on Le Havre. The mining aircraft were awkward enemies with which to cope; they frequently operated in single sorties, up to a total of 50 a night, the planes flying in low and dropping their mines out of range of the shore defenses; Such attacks were carried out on every night but one from 6-30 June and took toll of our shipping by reason of their persistence,

The mines laid by the enemy off our anchorages provided the biggest problem facing the Allied navies, since they included two novel, pressure-actuated types, one of which could not be swept at all with the gear available and the other only under certain weather conditions. The task of the mine sweeping flotillas was thus often thankless and always hazardous, for, though they detonated large numbers of mines and worked tirelessly with their accustomed bravery under often appalling weather conditions, some mines inevitably remained and our shipping necessarily suffered casualties. Serious as these losses might be, they were, nevertheless, not so heavy in proportion to the total number of ships we employed as materially to affect our build-up. The losses reached their peak in the days immediately following the great storm of 19-21 June, which had the effect of "ripening" many of the mines; but subsequently the casualty rate gradually declined. Despite the depletion of the mine sweeper strength through the losses incurred, the development of "explosive sweeps" and the use of nets to catch drifting mines partially reduced the dangers. It was not, however, until August, when the land advances forced the enemy to abandon his air bases for others farther east that his mining activity effectively died down. The extent of the menace may be seen from the fact that by three months after D-day the number of mines swept off our invasion ports and beaches totalled one-tenth those swept in all theaters combined from the beginning of the war to 6 June.

The threat to our supply routes from enemy destroyers was virtually removed on 9 June when Force 26 met and annihilated four enemy vessels off the Ile de Batz following their interception by RAF Coastal Command aircraft. Attacks by light coastal craft, however — E- and R-boats based initially upon Cherbourg and Le Havre — were carried out against the assault area with a persistence equal to that of the air mining effort. Although the enemy never dared to interfere with our build-up by day, his craft made forays against our anchorages almost nightly from D-day onward. A certain number of E-boats was transferred to Brest following the fall of Cherbourg, but the chief menace thereafter became concentrated in Le Havre, from which operations were directed primarily against the British anchorages. To guard against this, a protective screen was established on our eastern flank, and it was but rarely that the raiders succeeded in penetrating this barrier and destroying our shipping within. Our own

coastal forces were continually engaged in repelling the enemy, and the pursuit was often followed under the guns of the hostile shore batteries. The German forces suffered severely from attrition, our close blockade effectively preventing any appreciable reinforcement. Successful air attacks were also made by Bomber Command against the docks at Le Havre, sinking a number of E-boats and other craft at their moorings. When Le Havre finally fell to our forces in September, the danger to our western Channel routes and anchorages from surface attack was practically ended.

The German fondness for war gadgets was as marked in the naval as in the military and aeronautical spheres; on one occasion the naval commander on our eastern flank reported that this protective net was "bulging with secret weapons." Among these devices, in addition to the mines already mentioned, were human torpedoes, explosive motorboats, radio-controlled glider bombs, and even an occasional V-1 flying bomb, the latter arriving probably more by accident than design. As was inevitable in our crowded anchorages, we suffered a number of casualties from these devices, used in conjunction with more orthodox weapons, but the enemy also paid heavily for his use of them. On 2-3 August, for instance, a determined attack was launched on the British anchorages by human torpedoes and explosive motorboats, under cover of diversionary air raids and E-boat assaults. We lost a destroyer, a trawler, and an LCG, while other craft were damaged; but on the German side at least 20 explosive motorboats, 30 human torpedoes, and 1 E-boat were destroyed, and 2 more human torpedoes were caught in the net.

The submarine threat proved markedly less serious than we had anticipated. When the assault was first launched, the enemy U-boats were concentrated in the Biscay area, but at once began to move toward the Channel. RAF Coastal Command, however, had established a system of air patrols covering the whole of the western approaches to guard against this menace, and its operations were highly successful. U-boats approaching our supply routes were spotted, sunk, or forced to abandon their missions, and during the critical first 10 days of the invasion there was no evidence of penetration by a single craft. Later on, occasional U-boats got through under cover of bad weather, but the results obtained were insignificant.

In close liaison with the air watchers, Allied naval forces maintained a constant blockade along the Biscay and Channel coasts from the Gironde to Den Helder. From the outset of the campaign the Allied naval supremacy off western Europe was not seriously challenged, and apart from the raiding of the assault area by locally based small craft the enemy was compelled to restrict his activities to attempts by blockade runners to sneak from port to port, hugging the shores, under cover of darkness or foul weather. Several such convoys were intercepted and broken up, and by the end of the year 68 enemy vessels, from destroyers to small merchantmen, had been sunk at sea, while over 200 more had been scuttled, sunk, or immobilized in ports. Considering the enormous quantities of shipping which we employed, our own losses were negligible. By mid-July the position was sufficiently satisfactory to permit release of some United States destroyers for service in other theaters, and on 25 July the Admiralty resumed general control of the Channel from Admiral Ramsay (Allied Naval Commander Expeditionary Force) who, however, retained operational authority over the actual assault area.

Against the bases in England from which our convoys sailed across the Channel the enemy made no piloted air raids, but did make some use of flying bombs. A few of these missiles which fell in the Portsmouth-Southampton area early in July hit landing-craft bases but failed to cause any damage to the shipping itself. The primary object of attack, from 13 June onward, was always London, the bombs being employed essentially as terror weapons. Two LST's were damaged there at Deptford docks, but there was little direct interference with our build-up, and the work of loading proceeded without undue interruption. The gigantic concrete "secret weapon" installations in the Cherbourg Peninsula and the Pas-de-Calais, designed to enable V-missiles to be assembled and launched under conditions of immunity from Allied air attack, were captured before completion. For our freedom from effective interference by V-weapons we were indebted to the air forces, whose persistent attacks — first upon the experimental establishment at Peenemünde and subsequently upon the operational installations in France and the Low Countries — successfully delayed the enemy's preparations until they were too late to check our operations. The attacks against London were regarded as a serious menace and one of my tasks while I had control of all the air forces was to allot air effort to reducing the enemy scale of attack against the capital. In spite of the many tasks imposed on the air forces in connection with OVERLORD it was still possible to make many successful attacks

on the V-weapon organization, and the apparently large diversion of effort was in fact reduced, as far as possible, by selecting opportunities for attack when the weather was unfavorable for higher priority targets. The bombardment of London following our landings was a desperate and ill-conceived measure, for more profitable results would certainly have been achieved had the main weight of the attack even then been directed against the ports along the south coast. The enemy's vindictive hatred of the British people and his underestimation of the Londoners' powers of endurance, together with his own blind overconfidence in the effects of the new weapon, enabled us to continue our build-up and successfully to establish ourselves on the soil of France.

Our communications system was satisfactory. The Admiralty, the Royal Corps of Signals, and the British Post Office jointly achieved the feat of laying a cross-Channel cable, giving three telephone and six telegraph circuits, as early as D-plus-4, and a number of further cables were subsequently installed, affording adequate signal facilities with our bases in the United Kingdom. When the breakthrough came in France at the end of July the speed of the advances imposed a heavy strain on the communications personnel. Although the spearhead units necessarily relied largely on radio, a line network of great complexity was required in their rear to cope with the amount of traffic involved. Civilian communications were of limited value in consequence of lack of maintenance during recent years aggravated by war destruction, and within 4 months of D-day the Allies laid over 100,000 circuit miles of line.

Within France, the organization of our supply system did not present any major problems until our armies achieved their breakthrough. While we were consolidating our hold upon the lodgement area, the supply dumps to maintain the forces when the fighting became mobile were steadily built up, and the coastal area from the Cotentin to Caen developed into one immense depot, the biggest in history ever assembled on an invaded territory. When the breakthrough came, however, a great strain was imposed upon the maintenance system, not through any inherent fault in that system but by reason of the unexpected circumstances under which the advances occurred. The enemy's tenacious defense of the Brittany ports and my decision to concentrate all available strength fully to exploit the opportunity for a decisive victory offered in Normandy necessitated, as already indicated, the abandonment of the original plan for these harbors to be brought rapidly into use as the main arteries through which to supply the American armies on the right flank.

This meant that we had to rely for our maintenance at a most vital period of the campaign upon the original supply lines through Cherbourg, the Arromanches Mulberry, and the Normandy beaches. Some cargoes were unloaded through the minor harbors and over the beaches of northern Brittany, but they represented only a small fraction of our total needs. The bulk of the supplies for the Third Army had to be transported by the long, roundabout route down through the Cotentin and then eastward around the German pocket resisting at Falaise and Argentan. The Third Army, when it got into its stride in the dash across France, was advancing at a speed of up to 40 miles a day, and our transport services were taxed to the limit. The incentive offered by the chance of a smashing victory, however, drove the men in whose hands the maintenance of supply rested to feats of superhuman accomplishment. In the light of the difficulties they had to overcome, it seems, when one looks back upon those amazing days, well-nigh incredible that at no period up to the time when we stood upon the threshold of Germany was the momentum of the drive retarded through lack of essential needs. The spectacular nature of the advance was due in as great a measure to the men who drove the supply trucks as to those who drove the tanks.

The three essentials were food, ammunition, and gasoline; and to get these up to the armored spearheads in as expeditious a manner as possible the system known as the "Red Ball Express" was instituted. By this, a circular one-way traffic route was established across France from the beachheads to the fighting zone and back again. All civilian and local military traffic was debarred from using the "Red Ball Highway," and along it the convoys swept at high speed day and night, in an unending stream. Similarly on the railroads, many of them single-track lines never intended for such heavy usage, the trains, each loaded to capacity, pushed eastward, traveling nose to tail in a manner that defied all the normal rules of safety.

To keep all this traffic rolling would have been impossible but for the very fine work of the engineers, who had to contend with the damage caused not only by the enemy but by our own attacks preceding the advance. The roads were strewn with mines which had to be detected, wrecked German vehicles which had to be pushed aside, and bomb craters which

had to be filled. There were bridges which had to be rebuilt and the rubble of ruined towns and villages through which paths had to be driven. On the railroads there were again bridges to be constructed as well as wrecked trains to be cleared, torn-up rails to be replaced, and the frightful chaos produced by our bombing at every major junction and marshalling yard to be remedied. So greatly had the French railroads suffered that over 900 locomotives and a third of the rolling stock used had to be shipped over from Allied sources in England. Thanks to the untiring efforts of the men and the excellence of their mechanical equipment, all this work was successfully accomplished at an unprecedented rate. Bridge-building parties especially performed remarkable feats, and work which under normal conditions would have required months was completed in a matter of days.

With the resistance offered by the retreating enemy at a minimum, fuel was a more vital requisite than ammunition. Approximately a million gallons of gasoline were needed at the front every day to enable the armored columns to maintain the headlong rate of their advance. Trucked supplies could not by themselves cope with this enormous demand, but pipe lines, both for aviation anti ordinary purposes, were laid in the wake of the armies from the beachhead storage tanks. Our experiences in North Africa and Italy had taught us much in the matter of pipe lines, and as many as 30 miles of 6-inch pipe were now laid in a single day. By early October the system was delivering 4,500 tons of gasoline daily from the main distributing point near Paris, apart from the considerable quantities being drawn from it at other points intermediate between there and Cherbourg.

Despite all these efforts and accomplishments, however, my anxiety over the successful maintenance of supplies essential to support our continued advance increased as the lines of communication lengthened. The Third Army maintenance in particular was stretched to the limit, and, as previously described, we had to employ transport aircraft to carry over 2,000 tons a day to keep the spearheads going. The enemy's failure to make a successful stand on any of the river lines freed us momentarily from the necessity for airborne operations which would have taken away the planes from the task of keeping the ground forces supplied, but it was evident that sooner or later such a situation would arise when we came up against the main frontier defenses of the Reich.

As will be indicated in due course, the difficulties of supply eventually forced a halt upon us when we reached Germany, but the very rapidity of our advance across France had made that inevitable. In consequence of the enemy's denial to us of the Brittany ports and the unexpected situation of having to support a dash of such length and speed entirely from our bases on the Normandy shore, only a miracle of hard work and brilliant improvisation by the supply services had carried our armored spearheads so far. Without the magnificent work performed by these men in coping with peculiarly arduous problems, the sweeping victory which liberated France would not have been possible.