Turning the Tide of War: The Mulberry Harbors

FEW CAN FORGET the drama of D-day, depicted so vividly in such films as *The Longest Day* and *Saving Private Ryan.* Less often remembered, however, is the action that continued on the beaches of Normandy long after the initial invasion of June 6, 1944. In the weeks that followed, ships continued to transport thousands of vehicles, hundreds of thousands of tons of supplies, and more than 1 million men to those same shores to sustain the Allied advance. This triumph of logistics was made possible by an often overlooked marvel of wartime engineering, a pair of artificial harbors code-named Mulberry.

In the spring of 1943, as they began planning the invasion, Allied military leaders had two basic options: to attempt to capture a port city or to land on an open beach. Existing ports had the facilities that would make it possible to bring troops and supplies quickly onshore, but they were also well defended. A direct attack on a port would be long and bloody. And even if the attempt were successful, it would probably result in the destruction of the very infrastructure the Allies needed. A landing on an open beach, on the other hand, seemed to promise the element of surprise and a better chance of success. But how would such an invasion be accomplished without a harbor?

The answer, apparently suggested by Captain John Hughes-Hallett, of the Royal Navy, was that the Allies would manufacture their own harbors. At a secret conference in Quebec in August 1943, Prime Minister Winston Churchill, President Franklin D. Roosevelt, and the Combined Chiefs of Staff approved a plan to do just that.

The plan called for the components of two artificial harbors to be built in Britain, towed across the English Channel, assembled on the north coast of France immediately after the initial invasion, and placed in full operation within two weeks of D-day. American forces would erect one harbor, called Mulberry A, at Omaha Beach, while the British would construct another, Mulberry B, at Gold Beach, 10 mi to the east. The invasion was originally planned for May 1944, leaving Allied engineers just nine months in which to accomplish a feat so bold that the enemy never saw it coming.

The Allies built their own offshore port facilities on the coast of Normandy to ensure a steady flow of supplies in the wake of the D-day invasion. A vehicle lumbers across a floating bridge toward the shore. In the near distance the housings for the "spud" legs of the movable pierheads can be seen towering over the harbor.

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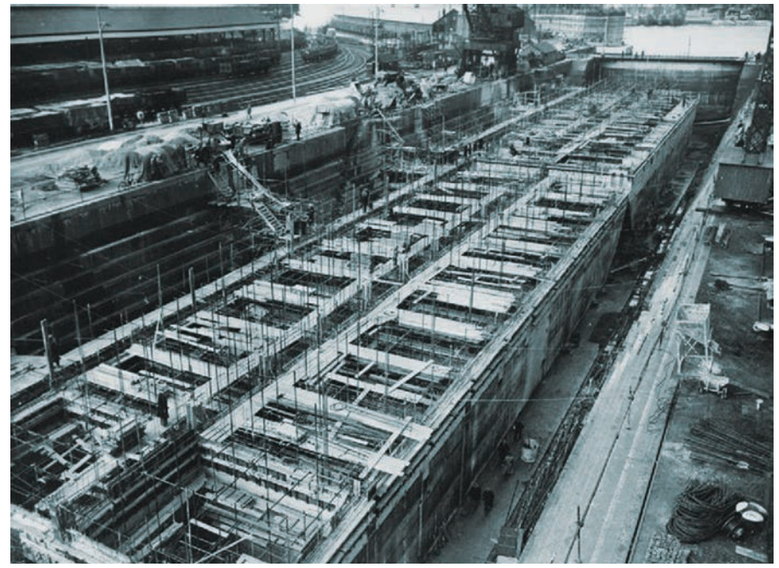
As it happened, British engineers had already been working on the problem. In early 1941 Major General Donald J. McMullen had established a branch within the War Office called Transportation 5, or Tn5, to deal specifically with port engineering. As the head of Tn5, Major Bruce White engaged some 150 civilian engineers from the private sector to assist with various aspects of harbor design.

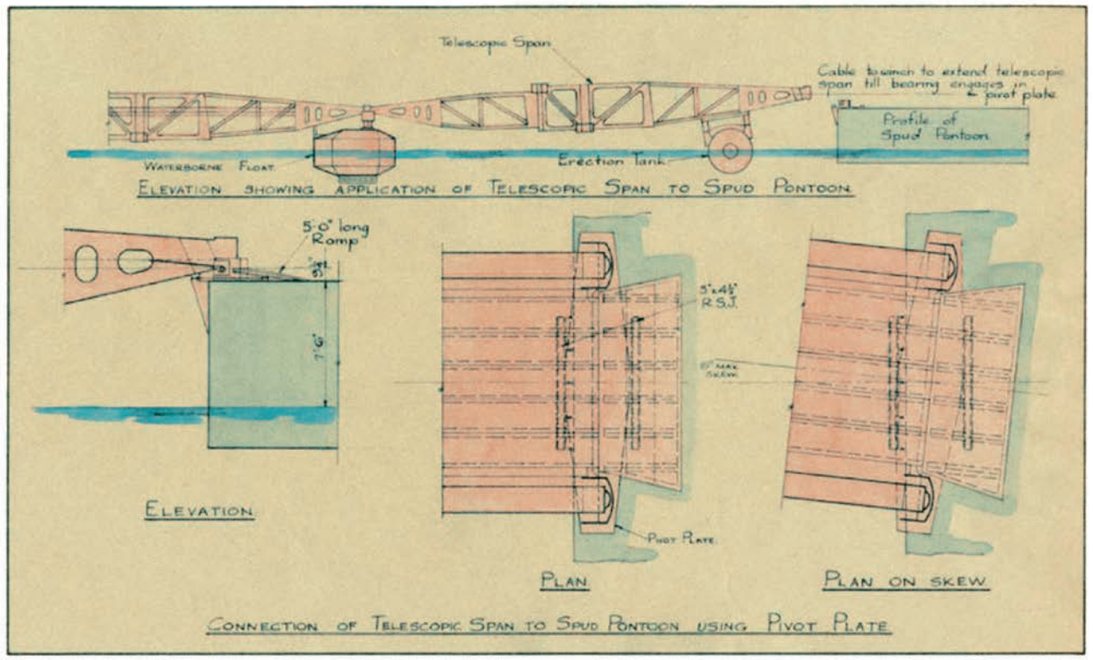
As of mid-1942 the invasion had not yet been planned, but Churchill anticipated a need for offshore port facilities. In May of that year he penned a memo entitled "Piers for Use on Beaches" to the War Office's chief of combined operations. The memo read simply: "They must float up and down with the tide. The anchor problem must be mastered. Let me have the best solution worked out. Don't argue the matter. The difficulties will argue for themselves." White took up the challenge. By the time the Combined Chiefs of Staff met in Quebec, Tn5 had produced working models of a movable pierhead.

British and American engineers collaborated to determine the types of structures that would be needed to make the harbors a reality. Because the invasion was to be launched from Britain, the Americans played a relatively small role in the design and construction of the harbors' structural components. The U.S. Navy did, however, assume responsibility for installing, operating, and maintaining Mulberry A at Omaha Beach.



Concrete caissons for the main breakwaters were typically constructed in two stages. Workers would first build the lower part in a dry dock, *above,* then launch it and erect the remainder of the structure from inside the caisson itself. Some of the floating bridge spans, *below,* could be lengthened or shortened to accommodate the tides.

The Mulberry program was top secret. The various structures that made up the harbors were prefabricated at separate locations and tested in out-of-the-way places so as not to attract attention. Often even the workers building a given component were not told what it was designed to do. Each type of structure



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also had a code name intended to conceal its purpose.

The mission of Mulberry was to maintain a constant flow of supplies at high tide or low tide irrespective of weather. The Allies were planning to land 9 divisions in the initial assault, followed by 20 more to secure the beachhead. In the first month after D-day, 18 of those divisions would continue to be supplied via the beach, and in the second month, 12 divisions would continue to rely on supplies delivered the same way. The Allies could not afford interruptions in the flow of supplies because of weather; nor could they afford delays caused by changes in the tide, which at that time of year could be as much as 20 ft.

On June 19, 1944, an unusually strong storm slammed the Normandy coastline. By the time it subsided, three days later, it had destroyed many of the offshore structures, *above.* Mulberry A was so badly damaged that the Allies had to abandon it. Mulberry B, however, was restored and continued to operate well into the winter, much longer than originally planned. Some of the concrete caissons, *below,* can still be seen today at Arromanches, France.

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Central to the entire enterprise were the pierheads, where ships would dock to unload tanks and supplies. Each pierhead consisted of a 200 ft long, 60 ft wide pontoon resembling a small ship that could be floated into position. It was fitted with four housings that looked like chimneys, through which 89 ft long "spud" legs could slide up or down. Cables controlled by electrically powered winches were used to drive the legs into the seabed to hold the pier in place. The pontoon could then be raised or lowered relative to the legs in the manner of an elevator. In this way it could continue to operate regardless of tidal conditions.

Of course, the pierheads would be of no use without a reliable link to the shore. To this end, Lieutenant Colonel William T. Everall, with the assistance of Major Allan H. Beckett, designed an ingenious floating bridge that consisted of 80 ft long steel spans resting on pontoons of either steel or concrete. Spherical bearings enabled the spans to twist in response to wave action without breaking apart. Moreover, some of the spans could be lengthened or shortened telescopically, enabling the bridge to accommodate tidal variations. Topped by a 10 ft wide roadway, the bridges were sturdy enough to convey a 25-ton tank.

The remains of the Mulberry harbors are an enduring memorial to the bravery and ingenuity of the men who designed and constructed them. Without these essential structures, the D-day invasion might never have happened.

The primary means of sheltering the harbor were the so-called Phoenix breakwaters, which would be formed of concrete caissons that would be towed into position and sunk end to end to form a continuous line. These bargelike caissons, which varied in length from 174 to 204 ft, were fitted with valves so they could be filled with water in a controlled fashion. Few dry docks were available for caisson construction. For this reason, many of them were built in two stages: workers would construct the lower part of the caisson in a dry dock, launch it, and then erect the remainder of the structure from a platform inside the caisson itself.

The Mulberry project prompted research on other types of breakwaters as well. Robert Lochner, a British yachtsman and electrical engineer, experimented with various types of floating barriers, one of which was adopted for the Mulberry harbors. It consisted of floating steel barriers cruciform in cross section that were 200 ft long, 25 ft high, and 25 ft wide. These barriers, called Bombardons, were anchored in rows in the open sea to form an outer line of defense against the waves.

The Allies knew that installing the breakwaters would take time. If the weather turned foul in the first two or three days after D-day, thousands of small landing craft would have nowhere to go. To solve this problem, the invasion planners marshaled more than 70 old merchant vessels that had outlived their usefulness. Like the caissons, these "blockships" were sunk in rows, end to end, to form breakwaters. The advantage of the blockships over the caissons was that they could cross the channel under their own power.

Despite employing tens of thousands of laborers, the construction effort was barely completed on time. Finally, on the afternoon of June 6, the first Mulberry vessels set sail. The British forces that arrived to install Mulberry B at Gold Beach met little opposition; the Americans, at Mulberry A, were less fortunate. Although the Allied troops had taken the beach, the area was still under fire. Some of that fire was directed at the men who were already trying to sink the first blockships in their proper position.

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The first Phoenix caissons were towed across the channel on June 7, although because of enemy fire the first units were not installed at Mulberry A until June 10. Nevertheless, four days later 32 of the planned 51 caissons were in place there and were providing some protection to the harbor.

Many aspects of the installation of the harbors did not go as planned. Despite all of this, for 13 days after the initial assault, the breakwaters, piers, and floating bridges did their job. Then, on the morning of June 19, disaster struck. The worst storm that part of the French coast had experienced in 40 years swept over the beach and lasted for three days. The British harbor, partially protected by local geographical features, survived largely intact, but Mulberry A was all but destroyed. The Americans soon abandoned their harbor, using the surviving equipment to repair the battered—but still standing—Mulberry B. The latter, in fact, continued to operate well into the winter, much longer than originally planned.

The degree to which the Mulberry harbors contributed to the success of the Allied invasion can perhaps never be fully known. Without the assurance that the harbors would be in place, however, it is quite possible that the Allied commanders would not have risked landing on open beaches at all. In that sense, the harbors were crucial to the entire invasion.

The remains of Mulberry B, including several Phoenix caissons, can still be seen at Arromanches, France. They are a testament to the ingenuity of the engineers who designed them, the dedication of the laborers who built them, and the bravery of the men who installed them in the most dire of circumstances.

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