

MULBERRY-AMERICAN: THE ARTIFICIAL HARBOR AT OMAHA

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE
Military History

by
BRETT PETERS, MAJOR, USAR
B.S., The Florida State University, Tallahassee, Florida, 1996

Fort Leavenworth, Kansas
2011-01

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE			<i>Form Approved</i> <i>OMB No. 0704-0188</i>		
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 10-06-2011		2. REPORT TYPE Master's Thesis		3. DATES COVERED (From - To) AUG 2010 – JUN 2011	
4. TITLE AND SUBTITLE Mulberry-American: The Artificial Harbor at Omaha			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) MAJ Brett Peters			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Command and General Staff College ATTN: ATZL-SWD-GD Fort Leavenworth, KS 66027-2301			8. PERFORMING ORG REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution is Unlimited					
13. SUPPLEMENTARY NOTES					
The Overlord operation is a widely-studied episode in military history. Often overlooked is a little known U.S. operation designed to overcome logistical problems in the Overlord plan. For the first 90 days of combat the Overlord operation would not benefit from major ports to sustain the buildup and counter the German attempt to push the Allies back into the sea. The Allies planned, designed, and constructed two artificial harbors to overcome the lack of ports. The harbors were known by the code name, Mulberry. The components were towed across the English channel with the invasion fleet and constructed under enemy fire. Mulberry A, the A stood for American, was completed three days ahead of schedule and doubled the throughput of U.S. supplies over the Normandy beachhead. Mulberry A was destroyed by a summer gale after only three days of operation and subsequently abandoned. Effective beaching LSTs during the operation led many critics to conclude that Mulberry A supply operations had little effect on the Overlord operation. To the contrary, using modern assessment methods, it can be concluded that the Mulberry operation was effective and influenced the outcome of the cross channel attack.					
15. SUBJECT TERMS Mulberry, Artificial Harbor, Overlord, World War II Logistics					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. PHONE NUMBER (include area code)
(U)	(U)	(U)	(U)	87	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: Major Brett Peters

Thesis Title: Mulberry-American: The Artificial Harbor at Omaha

Approved by:

_____, Thesis Committee Chair
Christopher R. Gabel, Ph.D.

_____, Member
Jon Mikolashek, Ph.D.

_____, Member
Michael T. Chychota, M.M.A.S.

Accepted this 10th day of June 2011 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

MULBERRY-AMERICAN: THE ARTIFICIAL HARBOR AT OMAHA, by Major Brett Peters, 87 pages.

The Overlord operation is a widely-studied episode in military history. Often overlooked is a little known U.S. operation designed to overcome logistical problems in the Overlord plan. For the first 90 days of combat the Overlord operation would not benefit from major ports to sustain the buildup and counter the German attempt to push the Allies back into the sea. The Allies planned, designed, and constructed two artificial harbors to overcome the lack of ports. The harbors were known by the code name, Mulberry. The components were towed across the English channel with the invasion fleet and constructed under enemy fire. Mulberry A, the A stood for American, was completed three days ahead of schedule and doubled the throughput of U.S. supplies over the Normandy beachhead. Mulberry A was destroyed by a summer gale after only three days of operation and subsequently abandoned. Effective beaching LSTs during the operation led many critics to conclude that Mulberry A supply operations had little effect on the Overlord operation. To the contrary, using modern assessment methods, it can be concluded that the Mulberry operation was effective and influenced the outcome of the cross channel attack.

ACKNOWLEDGMENTS

The writing of this work could not have been accomplished without the endless patience of my thesis committee. The motivation the committee instilled in me was sorely needed at times and for that, I am extremely grateful. Thank you for the encouragement, input, and motivation tailored to my personality type. I have never experienced what it means to write. I have now been educated.

I cannot in good form acknowledge any other party without giving thanks to my wife and family. Without the support of my clan this work would have perished in flames many months ago. My wife and four children are eternally patient, forgiving, and understanding. Thank you for putting up with my “~~moments~~” and giving up more than a few weekends while Daddy could work on “~~that paper~~”; I owe you.

Appreciation must be extended as well to the 2011, Command and General Staff School, Staff Group 15 Delta. I had more than my fair share of encouragement from Staff Group 15 Delta; More cowbell.

TABLE OF CONTENTS

	Page
MASTER OF MILITARY ART AND SCIENCE THESIS APPROVAL PAGE	iii
ABSTRACT.....	iv
ACKNOWLEDGMENTS	v
TABLE OF CONTENTS.....	vi
ACRONYMS.....	vii
ILLUSTRATIONS	viii
TABLES	ix
CHAPTER 1 CODE NAME MULBERRY	1
CHAPTER 2 LOGISTICAL MEANS AND METHODS.....	7
CHAPTER 3 PLANNING FOR MULBERRY	15
CHAPTER 4 MULBERRY A OPERATIONS	39
ILLUSTRATIONS	68
GLOSSARY	69
APPENDIX A MULBERRY TIMELINE.....	71
APPENDIX B CODE NAMES	74
BIBLIOGRAPHY.....	76
INITIAL DISTRIBUTION LIST	78

ACRONYMS

ANCXF	Allied Naval Commander in Chief, Expeditionary Force
CMSF(CO)	Coordinator of Ministry and Service Facilities (for Combined Operations)
COHQ	Combined Operations Headquarters.
ComNavEu	Commander U.S. Naval Forces Europe
COSSAC	Chief of Staff to Supreme Allied Commander
D-day	Day of invasion
LCA	Landing Craft Assault
LCI	Landing Craft (Infantry)
LCT	Landing Craft (Tank)
LCVP	Landing Craft–Vehicle, Personnel. Also known as a “Higgins boat”
LSD	Landing Ship (Dock)
LST	Landing Ship (Tank)
MOE	Measure of Effectiveness
MOP	Measure of Performance
RE	Royal Engineers.
RN	Royal Navy.

ILLUSTRATIONS

	Page
Figure 1. Rhino Ferry Unloading Cargo Ship	12
Figure 2. Rhino Ferry Beach Unloading	13
Figure 3. Diagram of Lobnitz Pier	27
Figure 4. Command Relationships	30
Figure 5. Mulberry A Design	33
Figure 6. Mulberry A Design (Clear Version)	34
Figure 7. Gooseberry Blockships at Omaha.....	41
Figure 8. Mulberry A From Above, 15 June 1944.....	45
Figure 9. Mulberry A From Above 23 June 1944.....	53

TABLES

	Page
Table 1. Landing Ship Tank by Class	9
Table 2. Tonnage Over the Beaches	47
Table 3. Tonnage From Beginning of Port Operations.....	48
Table 4. LST Offload Times	49

CHAPTER 1

CODE NAME MULBERRY

After the tragedy at Gallipoli in World War I Allied military leaders gave little credence to the concept of opposed beach assaults. The British Army prior to World War II had discounted the concept of an opposed assault as not viable and instead focused on landings on unopposed terrain. The U.S. Army acknowledged that opposed assaults may be necessary but failed to develop doctrine on beach assaults and instead chose to rely on the U.S. Marine Corps doctrine. The surprising capitulation of the French army in 1940 made an opposed amphibious assault a very real possibility as the Allies had no foothold on the mainland from which to launch any offensive against Germany. If there was to be victory over the Germans an opposed beach assault in German occupied France would be unavoidable. In preparation for just such a reality the Allies proceeded with operation Bolero in 1942. Operation Bolero was the codename for the U.S. forces build-up in Great Britain. While Bolero began the massive buildup of U.S. forces, operation Sledgehammer was planned. Sledgehammer was to be an opportunistic assault into German controlled France should the German army fall into disarray due to failures in Russia. In 1943 it became apparent to the Allies that a Sledgehammer opportunity was not forthcoming and the plan was shelved. Planning for operation Sledgehammer gave way to what was called operation Roundup, which later became operation Overlord.¹

The Allied invasion of Normandy remains one of the most fascinating operations in military history. No student of history can ignore the grandeur, individual stories of heroism, and terror that the beach assault at Normandy embodies. It is easy to focus on the heroic aspects of the Normandy invasion and the sacrifices made, but what cannot be

overlooked is that the invasion could not have taken place had one major limitation not been solved. Overlord planners had difficulty working through the problem of how to sufficiently supply the invading forces. The answer was to build an artificial sheltered harbor in England, tow it across the English Channel and install it under fire as the D-Day invasion took place.

The decision to embark on such a massive and expensive operation both in material and manpower was not taken lightly. Construction of the artificial harbors, codenamed Mulberry, was the only apparent answer to problems experienced in earlier amphibious operations. It was imperative that the errors made in assaults prior to Overlord not be repeated at Normandy. Errors and miscalculations at Dieppe, North Africa, Sicily, and Anzio were taken into account in brutally honest after action reports. These after action reports were not to be ignored by Overlord planners. If the same errors made in smaller operations were made at Normandy the results could not be so readily overcome in an operation of such magnitude.

The most significant lesson was the calamity at Dieppe 19 August 1942. In the commando raid at Dieppe Allied forces failed in an attempt to take a French port in a direct assault. The operation at Dieppe ended with appalling casualties to British and Canadian commandos, and Army Rangers. The Dieppe raid demonstrated to planners the very real likelihood that a direct assault from the sea would not be possible without unspeakable casualties, if the assault were possible at all.

Lessons learned at Anzio gave Overlord planners pause until the logistics question could be sufficiently addressed. Critical review of the Anzio operations demonstrated to Allied planners that their ability to logistically support forces over the

beaches was limited at best. Allied forces learned that a successful beachhead assault, even unopposed, cannot overcome inadequate logistics methods and slow resupply of ammunition, equipment, and replacements.

Original Overlord plans for the invasion of France called for an initial assault of only three divisions. It was calculated by planners that the initial beachhead assault might be supplied solely over beach, but logisticians would need to supply a total of twelve divisions by the end of the first week. By the end of the first month logisticians would need to supply twenty-four divisions solely over beaches; if a port could not be captured intact quickly enough Overlord would end in catastrophe. Adding to the problem for planners, operation Overlord's initial assault plan was later changed to five divisions, compounding the logistical issues.

The operations-logistics gap was an issue throughout planning for Overlord. Even if planners reduced the operation's size in order to account for beach resupply, the objectives were deemed difficult to reach and incurred too much risk. Early planning assumptions were based on limited objectives. The Normandy invasion was intended only to create an administrative base from which further operations could be launched and supplied. In every estimate even with limited objectives Allied forces reached logistical culmination before major resistance was even encountered. With the resources available in England in 1942 and early 1943 planners determined beach resupply by itself was out of the question, supply had to be augmented.

Particularly glaring to Overlord planners was the imperative to overcome in the "Atlantic Wall." The wall itself was not just a propaganda tool concocted by Doctor Goebbels; the wall was a very real concern to planners. The term Atlantic Wall had a

deeper meaning. On the surface, the Atlantic Wall represented the fortifications and guns placed on the French coast to repel invasion, but to Overlord logistics planners the Atlantic Wall was not just the beach fortifications, but the inevitable mobile counterattack. The panzers of the German 7th Army represented the most dangerous obstacle to the success of the operation, more dangerous than any beach fortification. The only hedge against keeping Allied forces from being pushed back into the sea was to land sufficient supplies and heavy equipment to defeat a German counterattack. Such quantities of supplies could only be brought in fast enough without fully functional ports. The Atlantic Wall had to be broken by logistics. Gen. Omar Bradley said on the eve of the invasion, "Just as soon as we land, this business becomes primarily a business of buildup. For you can almost always force invasion, but you can't always make it stick."²

German planners estimated that the Allies needed to land one-million personnel to overcome the fifty plus German divisions available in Western Europe. Some among the German staff were largely unconcerned about Allied forces gaining a beachhead; they knew that without the benefit of a port for the invasion the Allies could not land the necessary infantryman, armor, and artillery to overcome a German counter offensive. The key component of the German plan to defeat the Allied invasion was to deny, at all costs, the use of a port.

In order to defeat Germany, an opposed beach assault by Allied forces must successfully gain a beachhead in France and move inland to establish the necessary administrative bases to sustain further offensive operations. Such forces could only be sustained by a working port. Without a functional sheltered port or the ability to capture a large port intact, the answer was artificial ports code named Mulberry; build a harbor in

England and bring the structure with the invasion force. Overlord was given the green light by national leadership and the operations would move forward with Mulberry as a most secret but key component. The harbors, constructed in England and towed across the English Channel, were designed to give the needed additional logistical support only a sheltered port could provide. The two harbors installed on the far shore were the result of fantastic vision, detailed planning, and almost superhuman exertion--all with a single goal in mind; support the combat soldier during the breakout at Normandy. To this end, how effective were the harbors completed at Normandy? Mulberry A (American), constructed at Omaha Beach and Mulberry B (British) constructed at Arromanches near Juno beach, were an enormous and expensive endeavor both in manpower and material. Critics have stated that in the end Mulberry A was wasteful, unnecessary, and played little role in the overall success of Overlord. Many believe the value of Mulberry A was other than its logistical output or gross tonnage. This paper will touch on such statements.

In chapter 2 the logistics means and methods the Allied forces had available to them will be analyzed. Logistics capabilities, available shipping, and other factors vital to Overlord logistics planners require scrutiny. Chapter 3 will further focus on the planning for the Mulberry harbors. Chapter 4 will focus primarily on Mulberry A operations. Precisely what took place, when, and what were the effects Mulberry A operations had on the Allied breakout at Normandy? The study of operations in chapter 4 will focus primarily on the United States operations at Mulberry A; however, British operations at Arromanches cannot be ignored due primarily to U.S. forces use of Mulberry B after the destruction of Mulberry A at D+13. Finally, chapter 5 will establish that the initial

decision regarding Mulberry A by U.S. senior leaders was wrong, and their assessments, flawed.

¹There were many other plans and operations generated by various planning bodies prior to what eventually became Overlord. The British began planning for a return to the mainland soon after Dunkirk. Plans generated by organizations like Combined Operations offer an interesting dynamic to the overall picture. For a detailed explanation of the Overlord planning process refer to *Cross Channel Attack* by Gordon A. Harrison.

²Edward Ellsberg, *The Far Shore* (New York: Dodd, Mead and Company, 1960), 286.

CHAPTER 2

LOGISTICAL MEANS AND METHODS

Deep within the rationale behind the overall Overlord plan was a logistical problem. Overlord in its inception was to provide logistics bases from which to launch further operations. There was little thought given to decisive operations. The preponderance of the planning was based on logistics and how to out-build the Germans logistically. How the British and Americans were to accomplish this was a difficult question. Planners had to ask, how were they to supply such an operation without the use of ports?

The problem of landing supplies over the beach was a new and unanswered question for logistics planners. Planners were working under the resource restrictions of 1942-43 while working out the details for a cross channel attack. There were severe limitations on English shipbuilding in 1942-43. After a suitable invasion location was found, Normandy, commanders calculated that Allied forces could not be maintained entirely through captured ports until D+90. A portion of the lines of communication would have to be maintained over the beaches and, on a very limited basis, through the air, for the first three months.¹

With these issues in mind the enabling factors of the invasion would center on shipping, beach organization, and port reconstruction. Each factor was extremely important to the Overlord maintenance plan. Most important to Mulberry, however were the shipping aspects of the plan.

Planners identified early that there was a severe lack of available landing craft. Nearly all of England's shipbuilding capacity was dedicated to the manufacture of

merchant vessels and combat ships for use in the U-Boat campaign. Logistics planning for a cross channel attack was based on the capabilities and limitations of known craft, and for logistics the craft of most concern were primarily the Landing Craft Tank (LCT) and Landing Ship Tank (LST). The LST was a 1,500 ton cargo vessel the British had yet to see and the LCT was a smaller 284 ton landing craft. Planning centered on the LST and LCT as the primary means of pushing tonnage over the beaches.

The most important vessel for discharge of supplies was the LST. The LST was a 327 foot, 1,500 ton vessel of British design, capable of carrying 2,000 tons of tanks and other supplies.² What made the LST unique was the LSTs size coupled with the ability to discharge supplies directly onto the beach. Due to British limitations in shipbuilding early in the war, the LST design was given to the Americans for construction and delivery under the Lend-Lease-Act. Other smaller craft had the same capability of landing and discharging on the beach, but the LST was much larger and could carry those same craft to the assault beach over open sea. The quality of being a landing craft as well as a large cargo ship made the LST extremely valuable and there were never enough in the European theater. There were four versions of the LST (see table 1). The primary LST featured in logistical planning were the Mark 2 and Mark 3.

Table 1. Landing Ship Tank by Class			
Type	Capacity	Displacement	Speed
LST 1	One LCM or LCS; thirteen 40 ton tanks or twenty-seven loaded 3 ton trucks.	2,840 light, 6,007 loaded	18 knots
LST 2	1600-1900 tons. (400 tons main deck load)	4,080 tons at sea, 2,366 landing	12.1 knots
LST 3	Five LCA, one LCT(6) or fourteen trucks on upper deck; twenty-seven 25 ton or fifteen 40 ton tanks on tank deck	4820 tons loaded, 3,065 tons beaching	13.5 knots
LST 4	Nineteen to twenty-one LVT, twenty-nine to forty-four DUKWs, 800 troops, 1,800 troops w/out vehicles	17-18feet	19.5 knots

Source: Department of the Navy. Office of Naval Intelligence (ONI) 226, *Allied Landing Craft and Ships* (Annapolis, MD: Navy Institute Press, 1944). Note: Displacement figures for the Mark 4 were not printed in the government intelligence guide used as a source. It can be surmised that the displacement is similar to the Mark 3, as the vessel's dimensions are similar.

The LCT was the other major mover of supplies. The British literally designed the LCT around a tank. The LCT was specifically intended for delivery of armor, vehicles and supplies directly onto the beach in an assault. The LCT Mark 1 was the prototype for the succeeding three British designs. The British LCT in all its variations could generally carry three to five tanks depending on the version. The design was later improved by the Americans who produced the LCT Mark 5. The Mark 5 could carry five 30 ton tanks, or four 40 ton, or three 50 ton tanks; or nine trucks. Unfortunately, all versions of the LCT were slow, averaging a maximum speed of 7 knots.³ The slow speed limited the LCT to

the assault area even though it was capable of operations in the open water. The LCT was too slow to safely maneuver and avoid the enemy in the open waters of the channel.

The shortage of landing craft was a constant planning issue. Operations at Salerno were hindered by the Allies' inability to follow up with needed supplies and personnel, largely due to the shortage. The issue of lack of craft became even more urgent for Overlord planning when Eisenhower and Montgomery expanded the invasion plans. Planners estimated the broadening of the assault would require an additional 231 landing craft the Allies did not possess.⁴ Later modifications to the Overlord plan helped to alleviate this issue. Commanders delayed the invasion for a month and Shelved operation Anvil, a simultaneous invasion in the South of France. The one month delay of Overlord and the postponement of Anvil allowed for the manufacture of desperately needed additional landing craft.

It was estimated during the detailed planning that eighteen divisions would have to be initially supported over the beaches in the first month.⁵ Planners believed the beaches adequate for such supply given the landing craft requested. However, if the weather interrupted shipping as it often did there would be severe shortages. Sheltered water had to be found that could handle 6,000 tons per day by D+4-5, 9,000 tons per day by D+10-12, and 12,000 tons per day by D+16-18.⁶

Supplies needed per division were calculated to D+90 and throughput was planned in three distinct phases.⁷ Originally resupply was to begin as a push system with assault division supplies moved ashore in packages at preplanned levels. Once a lodgment was secure and supply depots were established, the system would move into semi-automatic phase with the issuance of controlled items and ammunition based on unit

status reports. The third phase, once the supply system was firmly established and operating smoothly, was to be by requisition.

When the supplies landed they were to become the responsibility of the Engineer Special Brigades. The brigades were responsible for the technical aspects of managing the supplies and moving them forward off the beaches to depots and dumps.⁸ The mission of the Engineer Special Brigade was to regulate and facilitate the landing and movement of personnel and equipment on and over the beach to assembly areas and vehicle parks, to unload cargo ships, to move and receive supplies into beach dumps, to select, organize, and operate beach dumps, to establish and maintain communications, and to evacuate casualties and prisoners of war over the beach to ships and craft.⁹

The final goal of the logistical plan was to hand over the lines of communication to the ports and cease beach supply operations by D+90. Plans for Overlord maintenance all hinged on capturing ports and putting ports back in operation. Eventually each port captured would ease the burden off of beach logistics and the Mulberries. The Normandy area itself was chosen for its proximity not just to Cherbourg, but also because Normandy was between two major groups of ports, the Seine and Brittany groups.

Two other craft need to be mentioned. Note, however that these vessels were not largely factored into the logistics plan as major movers of supply until later in planning. The DUKW and Rhino ferry played significant roles in the beach supply effort. Rhino ferries were large pontoon barges with outboard motors designed to offload large quantities of materials from waiting cargo ships. Rhino ferries were an American contribution to the Mulberry harbor scheme. The Ferries were so large that two ferries could completely offload an entire LST.¹⁰ The Rhino craft themselves were difficult to

maneuver and required a highly trained sailor to handle in the harbor. They could not be used in rough water. (For photographs of a Rhino ferry, see figures 1 and 2.)



Figure 1. Rhino Ferry Unloading Cargo Ship

Source: Walter Bedell Smith, Collection of World War II Documents 1941-1945, Box 48, Amphibious Operations, Northern France Western Task Force, June 1944, Dwight D. Eisenhower Presidential Library



Figure 2. Rhino Ferry Beach Unloading

Source: Walter Bedell Smith, Collection of World War II Documents 1941-1945, Box 48, Amphibious Operations, Northern France Western Task Force, June 1944, Dwight D. Eisenhower Presidential Library

The DUKW was a U.S. manufactured amphibious vehicle, also known as a “Duck.” The D stood for the year, 1942; the U stood for Utility; the K was for front-wheel-drive; the W, two rear driving axles. This vehicle had the ability to hold 2,000 pounds of material, ferry it from deep water and drive supplies directly onto a beach and forward over land to the depot, bypassing the beach supply dump. Like the Rhino, the Duck could only operate in sheltered water. It rode dangerously low in the water, especially when loaded.

The key to the invasion was the LST. The Mulberry was largely designed around the LST, and operations depended on the ships capabilities. The other craft were planned in important roles, but all bets hinged on the versatility of the LST. The LST was the most valuable ship in the invasion save combat vessels. Mulberry was designed for the LST, and the LST was designed to carry Overlord.

By late 1944 the Allies possessed the vessels and vehicles needed to conduct Overlord. To do their job they needed sheltered water. For the invasion to succeed the logisticians needed a full-fledged port. To fulfill those needs, Mulberry was born.

¹Roland G Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944* (Washington, DC: Center of Military History, United States Army, 1953), 181.

²Ibid.

³Department of the Navy, Office of Naval Intelligence (ONI) 226, *Allied Landing Craft and Ships* (Annapolis, MD: Navy Institute Press, 1944).

⁴Ruppenthal, 185.

⁵Ibid., 270.

⁶Ibid., 271.

⁷Steve Robert Waddell, *United States Army Logistics: The Normandy Campaign* (Westport CT: Greenwood Press, 1994), 29.

⁸Ruppenthal, 283.

⁹Ibid.

¹⁰Waddell, 55.

CHAPTER 3

PLANNING FOR MULBERRY

I put forward my project in very general terms, merely pointing out that, since the French ports were strongly defended, we could not achieve strategical surprise or even tactical surprise. We must to some extent rely instead on technical surprise.

— Rear Admiral John Hughes-Hallett, *Force Mulberry*

In the simplest of terms the plans for the artificial harbors at Juno and Omaha beaches were sustainment operations. Force projection, as an operations concept, involves five processes: mobilization, deployment, employment, sustainment, and redeployment. Under the process of employment there are four separate types of operations: entry operations (both opposed and unopposed); shaping operations; decisive operations; and post-conflict operations. From the initial planning until execution, Overlord was only intended to be an opposed entry operation and at best, over time, a shaping operation--that is an operation that creates or preserves the conditions for the success of the decisive operation.¹ The goal of the initial plan was simple; to gain a beachhead and establish administrative supply bases from which further offensive operations could be launched.² Overlord was never intended to be the decisive operation that it is viewed as today. Mulberry was the plan to sustain the forces conducting a shaping operation and enable the build-up of necessary supplies for decisive operations at a later time.

Exactly how Mulberry came about as part of the Overlord plan was complicated, just as the planning for the Overlord operation was a massive undertaking that took place over multiple years. In 1942 soon after U.S. entry into World War II, the planning for the

artificial harbors largely paralleled Overlord and its various operational predecessors. A detailed overview of Overlord planning is not possible within the scope of this paper, however a general overview and background is necessary for understanding Mulberry planning.

In 1942 there was considerable pressure on the British to agree to the opening of a second front. To the U.S. it appeared that the British were hesitant to go on the offensive. Quite to the contrary, Churchill was eager to go on the offensive, but not eager to be suicidal in launching a cross channel attack too soon. The British did not seriously consider opposed amphibious assaults as possible prior to World War II, especially after Gallipoli. It was widely viewed by the British that a beach assault must be unopposed in order to be successful. The British experience in World War I caused a hesitancy to enter into operations of attrition. As the British saw it, superior firepower was the key component to victory. Such firepower was not possible within the resource limits evident in England in 1942. Winston Churchill however, was offensive minded and still eager to engage the Germans. Churchill's methods simply took a different path. Cognizant of resource limitations Churchill first set upon raids planned and executed by an organization known as Combined Operations.

Combined Operations Headquarters (COHQ) was formed under the Admiralty in 1932 to conceptually study amphibious operations. COHQ was the conduit Churchill used to move the War Office into an offensive mindset. A small organization at the start of the war, COHQ's role was to develop tactics, and otherwise harass the Germans. This had the effect, whether intended or not, of putting the Germans into a defensive mindset rather than the mindset of invading Great Britain. Churchill had staffed COHQ with his

most aggressive and forward thinking officers. Churchill named Admiral of the Fleet Sir Roger Keyes Director of Combined Operations on 17 July 1940.³ Admiral Keyes was the type of officer who thought in an unconventional way. Keyes thoroughly irritated the War Office with his unusual ideas for raids and small-scale operations, but small operations were all the British could manage and represented precisely the type of action and tactics Churchill was looking for—small victories. Through these small victories Combined Operations established itself as an innovative planning force and skilled staff for the tasks ahead.

As 1941 came to a close, Churchill decided a change in leadership at COHQ was necessary. Keyes had done his job and thoroughly instilled an offensive mindset through Combined Operations, younger blood was needed. Churchill had yet to empower COHQ to make his desired effect on the War Office. Churchill named Commodore Lord Louis Mountbatten the new Director of Combined Operations. In six months Mountbatten increased the number of officers on staff at Combined Operations from twenty-five to more than 400.⁴ Soon after the United States entered the war, Churchill promoted Mountbatten to Admiral of the Fleet and awarded Mountbatten equivalent ranks of General and Air Marshal. At the age of forty-one Mountbatten had the title of Chief of Combined Operations, and was a full member of the British Chiefs of Staff,⁵ much to the Chief's displeasure. Additionally, Mountbatten was added to the planning body tasked with developing the plans for the cross channel attack, the Combined Commanders.⁶ Mountbatten was to become a key planner of Overlord.

The Arcadia Conference on 31 Dec 1941 concluded with a tentative agreement as to how Britain and America were to conduct joint operations against Germany.⁷ To that

end Churchill acted quickly and set Mountbatten and his staff to work on analyzing offensive opportunities. Mountbatten's staff specifically had the task of developing amphibious operations, the original purpose for Combined Operations as an organization. Plans for operation Bolero, the U.S. buildup of men and material in Britain had begun.

Mountbatten appointed Major General Harold Wernher as Coordinator of Ministry and Service Facilities (for Combined Operations) (CMSF(CO)) on 20 April 1942.⁸ Wernher was designated the single officer responsible for preparing England as a base for large scale invasion preparations. Operation Bolero, the American build-up in preparation for Operation Sledgehammer, and later Overlord when Sledgehammer was shelved, was essentially Wernher's problem when it came to English facilities. Wernher's focus was ports, both in receiving the massive influx of men and material and later ejecting the same--only combat loaded for the cross channel assault. Wernher's background was business, and he was a highly successful manager. Both Wernher and Mountbatten would later play key roles in the Mulberry operation.

At the same time the German leadership believed that mobility was the answer to the defense of western Europe. Generalfeldmarschal Karl Rudolf Gerd von Rundstedt, Commander Oberbefehlshaber West, or OB West, the German Army command tasked with the defense of western Europe, employed a classic defense when faced with a large geographic front. Von Rundstedt's prevailing idea was mobility and a crushing counterattack to push any assault back into the sea. But the German General Staff was hamstrung by Hitler's defensive mindset and his fascination with heroic stands and using impregnable defensive structures—a mindset of a World War I corporal in spite of the tactics that earned the German Army victory in France. Most importantly, Hitler focused

on the ports. Hitler believed if Germany could hold the ports, they could hold all of Europe.⁹ To say the French ports were well defended by Germany was an understatement.

The Dieppe Raid, 19 August 1942, was a Combined Operations test of amphibious tactics and machinery. Most importantly, Combined Operations wished to test the viability of its new LCT in landing armored vehicles directly on the beaches in an attempt to take a port in a direct assault.¹⁰ The attack was a tactical disaster, but there was one unintended success behind the raid--the German reaction to the raid. The failure of the Dieppe Raid fed further into the German delusion that their defensive strength was sufficient and their tactics were sound.¹¹ Many senior leaders believed German doctrine was sound in spite of the evidence from captured Allied orders specifically stating the raid had been limited. German leadership continued to invest heavily in coastal defense, contrary to the German Army's experiences and successful strategy developed in the interwar period.¹²

The main purpose of the Dieppe raid was not to take the harbor as the Germans believed. The British knew Dieppe was well defended; Combined Operations wanted to know how well defended. The raid simply confirmed what Combined Operations already believed; the Allies could not take a harbor in a direct assault without extreme cost.

Planners needed an answer to the port problem. If the ports were so heavily defended there had to be an alternative. If the invasion was to take place over an open beach, how do the Allies account for not having the heavy lift that a port provides? The idea for artificial breakwater had been making the rounds at Combined Operations since 1940 and was being worked on by Brigadier Bruce White, an engineer at the War

Office's Transportation Directorate. The artificial harbor idea was still in its infancy, but Mountbatten believed that he had already found the solution. Had the Dieppe Raid not taken place the Allies may have made the mistake of attacking a port during the actual invasion, which would have been disastrous.¹³ Mountbatten, with the Dieppe raid, had gained the ammunition needed for the artificial harbor concept and assault over beaches versus assaulting ports directly. Harrison, in *Cross Channel Attack*, stipulates that after Dieppe, Roundup planners began to move toward concentrating forces rather than separate commando and regimental attacks across a wide front as originally intended.¹⁴ The Dieppe raid also had the effect of shelving operation Sledgehammer, a port assault, in favor of Roundup.

The War Office Director of Transportation established Transportation 5 (Tn5) in 1941 with port engineering its specific purpose. In charge was Bruce White.¹⁵ Initially Tn5 was concerned with building military ports in England, but as the war expanded so did its responsibilities. In the fall of 1942, not long after the failed Dieppe Raid, Mountbatten, as head of Combined Operations, gave Tn5 the responsibility of design and testing of port mechanisms for an artificial harbor.¹⁶ Mountbatten had received a minute from Churchill regarding the artificial harbors which Mountbatten passed on to White. The minute stated: "They must float up and down with the tide. The anchor problem must be mastered. The ships must have a side-flap in them, and a drawbridge long enough to overreach the moorings of the piers. Let me have the best solution worked out. Don't argue the matter. The difficulties will argue for themselves."¹⁷

In response to the hand written note from the Prime Minister, Brigadier White requested a meeting with the Prime Minister. During the meeting he explained how

White had witnessed a rock dredger in 1924 survive a storm that destroyed every other vessel in the harbor.¹⁸ The dredger was built by a company called Lobnitz and it survived by hydraulically lifting itself off the ocean on three legs firmly planted in the sea floor. White went on to explain other port mechanisms Tn5 was testing. Churchill, after White's explanation was satisfied the artificial harbors were underway and were being given proper attention. White returned to his work at Tn5 with a new ally--the Prime Minister.¹⁹ White later enlisted the assistance of Pearson Lobnitz, the designer and manufacturer of the rock dredger described to the Prime Minister.

In January 1943 the Casablanca conference convened. The most pertinent topic on the agenda was operation Torch, the Allied effort in North Africa already in progress. The Combined Chiefs of Staff did agree however, that a cross channel attack should take place and that a combined staff of British and American officers should begin planning for an invasion of Western Europe to take place in 1944. Soon after the Casablanca conference, in April 1943, the British Chiefs of Staff officially established the staff as directed by the Casablanca conference. The combined staff of American and British officers would be headed by British General Fredrick E. Morgan, who was to hold the title of Chief of Staff to the Supreme Allied Commander (Designate). The staff as a whole came to be known by the shortened title for General Morgan, COSSAC.²⁰ Roundup was no more, it was soon to become operation Overlord.

In June 1943 Mountbatten called for a conference to bring the Overlord planners together in Scotland. Chaired by Mountbatten, the Rattle conference (Largs conference) involved all planners including COSSAC planners brought together in an effort to come to the necessary decisions as to how the amphibious operation was to work. With the

means and methods of invasion established, Mountbatten set to ease hesitations over logistics with his plan for artificial harbor. The conference covered in broad outline how the harbor was to work, and who exactly was responsible for what part. It was at the Rattle conference that the harbor idea was first disclosed to the U.S. Army. Captain Hughes Hallett, Chief Naval Planner for Combined Operations briefed the artificial harbor plan, not yet code named Mulberry. The U.S. Army was impressed by the artificial harbor idea and requested the Army's own port.²¹ Until this point only COSSAC planners and a handful of officers at Combined Operations and the War Office, knew of Mountbatten's complete plan for the artificial harbors.

COSSAC began developing three plans for invasion in late May. In addition to Overlord, COSSAC planned a diversionary attack in 1943, as well as an attack in case of German collapse. Over the summer of 1943 COSSAC planners completed the outline of what became Overlord.²² General Sir Frederick Morgan's planners worked within the limitations and reality as they saw it in the summer of 1943. Planning for Overlord revolved around the same questions of limited resources, limited personnel, and limited landing craft. General Morgan was privy to Mountbatten's artificial harbor plan and he accepted the risk of landing on the beaches of Normandy because he counted on at least two artificial ports being built.²³ COSSAC presented the Overlord plan in an outline stage to the combined Chiefs of Staff at conference in Québec. Taken away from the conference were the key planning factors of the assault area, the availability of ships and landing craft, and the capacities of beaches in the lodgment area.²⁴ The plan was ratified at the Quebec conference and invasion date set.

The United States brought a team of experts and engineers to the Québec conference. At Mountbatten's request Wernher, Major Vassel Steer-Webster (later Colonel), and Brigadier Bruce White were brought to Québec to sell the Mulberry idea to their U.S. "opposite numbers."²⁵ Wernher and his team successfully piloted the Mulberry idea through the harbor committee at Québec and later traveled to Washington to do the same with the Joint Chiefs of Staff. The ideas and concepts were presented in their most elementary form, mainly due to the fact that they were only ideas and concepts, but the artificial harbor idea was sold on both accounts. The real work was just beginning.

Work on the artificial harbors began at a dizzying pace following the Québec conference. Combined Operations did not have the facilities or expertise for such a massive and technical operation. The British Admiralty and the War Office with the 150 plus engineers of Tn5 were responsible for artificial harbor construction. The harbor was given the codename Mulberry. The name Mulberry had no particular meaning; Mulberry was simply the next name on a list of approved code names. The War Office deemed Mulberry such a priority that the War Office authorized the testing and construction of the components to move forward simultaneously at significant expense.

Competition and resentment between the Admiralty and the War Office caused a number of problems and put the overall success of the Mulberry plan in doubt. The Admiralty was already responsible for towing the harbors across the channel, an obvious Navy job, and continued with experiments on their version of mechanics for the harbor. Unlike the U.S. Navy and their Naval Construction Battalions (CB's), the Admiralty had no construction engineers that could undertake such a project. This left the engineering, layout, and construction of the harbors up to the Royal Engineers of the War Office. The

situation naturally caused consternation with the Admiralty. Mountbatten could see the issue surfacing and decided there was a need for a single authority in charge of Mulberry.

In his position as CMSF(CO) Harold Wernher had successfully managed the building of Bolero facilities and in the end Wernher oversaw construction of one-hundred and seventy-one embarkation points from which the LCTs and LSTs would embark with armored vehicles and personnel on the day of the cross channel attack.²⁶ On 7 July 1943 Mountbatten recommended, in a minute to the Chiefs of Staff, that Wernher be named the single authority to deal with Mulberry. The recommendation went through, and on 24 August 1943 Harold Wernher was promoted to Major General,²⁷ and given charge of Mulberry facilities construction.

Key to the issues with the harbor planning and implementation was the fact that the British never designated a combined or joint staff for the Mulberry project. This is curious, because the British Combined staff served as the U.S. model for joint operations through World War II and beyond. Through design, construction, and implementation the project was a conglomeration of the War Office, Combined Operations, and the Admiralty. Wernher's force of personality and will were the key factors that pulled the project together.

In May of 1943 Major Steer Webster was called into a meeting of the Combined Chiefs of Staff. Such a meeting was a highly unusual situation. A mere major was rarely given the chance to address the Combined Chiefs of Staff. The Prime Minister had placed artificial harbors on the agenda for a coming meeting of the chiefs and expressed his displeasure about progress in the harbor decision-making. The Combined Chiefs of Staff were forced to act. Given Webster's standing as an expert engineer, the Combined Chiefs

wanted to hear his opinion as to which harbor system tested by Tn5 was best. Webster was called to represent the War Office, but he was intercepted by Mountbatten and prepped for his testimony. He and Mountbatten both agreed that the Lobnitz piers and Whale roadways developed by Tn5 held the most promise against three other designs tested. Webster presented the facts to the Combined Chiefs of Staff as he saw them and after deliberation the Chiefs voted to use the Tn5 recommendation.²⁸

The Mulberry harbors would now be made up of an outer breakwater of floating steel structures called Bombardons, anchored in the open sea in two rows with 400 yard intervals between them and lying parallel with the inner breakwater. The Bombardons were inserted at the insistence of the Admiralty who developed the concept. An inner breakwater of concrete caissons called Phoenix in the deep water was designed by Tn5. A breakwater consisting of sunken block ships called Gooseberry was to be added later in the planning. Inside the harbor would be piers, six for the U.S. and nine for the British port. Attached to the piers floating up and down on the tide was to be a roadway called Whales connected to the mainland.²⁹

The inclusion of the Admiralty's Bombardons in Mulberry design was a poor decision by the Combined Chiefs of Staff. The decision is an example of how petty rivalries in joint operations can have a negative affect at the tactical level. The Bombardons were based on what was known as a Lilo. A Lilo was a rubber mattress used in swimming pools. A British Navy lieutenant noticed that the Lilo broke wave action and brought the idea to the Admiralty. Designers had massive rubber floats manufactured for testing. Results of the initial tests were encouraging; however the scarcity of rubber made them impractical. In the end the Admiralty decided to manufacture the Bombardons

of steel.³⁰ Bombardons were 200 foot long, cross-shaped, steel plated floats. The Bombardons took precious steel from the manufacturing of the Beetles, the component that held up the Whale bridging and piers. The loss of available steel for the manufacture of the Beetles would later affect operations. The Bombardons were of dubious functionality. The steel forms were untested in the open sea, as were the Bombardon moorings.

The Mulberry harbors were designed primarily around two craft, the LST and the LCT, the most capable of maintaining the tonnage necessary to accomplish the purpose of Mulberry, was the LST. Although the LST was designed by the British, due to resources shortages it was manufactured in the U.S. The first LST did not arrive from the Mediterranean until after the North African landings had been completed.³¹ Testing on LCTs, the smaller of the craft, had been ongoing and alterations were being made both to the craft and the piers, but the LSTs were untested newcomers and only began arriving after September 1943. Only then could Mulberry planners test if an LST could land on the buffer pontoon of the Lobnitz pier-head that engineers had so carefully designed. Twenty-two Lobnitz pier-heads were under construction at various locations, based on a design agreed to in May 1943, but never tested with the primary means of moving tonnage, the LST. Ironically the first to test the viability of an LST landing on the Lobnitz pier-head were the Americans at the insistence of U.S. Navy Captain Dayton Clark, eight months after the LSTs began arriving. The first test in May 1944 failed. The LST could not open its doors on the pier-head.³² There was a mad scramble to make modifications to the pier-heads. Such a mistake so late in execution of Mulberry caused a great deal of frustration among senior leaders and damaged the credibility of the project in the eyes of

the U.S. Navy, specifically Rear Admiral Alan B. Kirk, the Normandy task force commander. Many on Kirk's staff were quiet about their opposition to Mulberry only because the concept was pushed from the Prime Minister down.

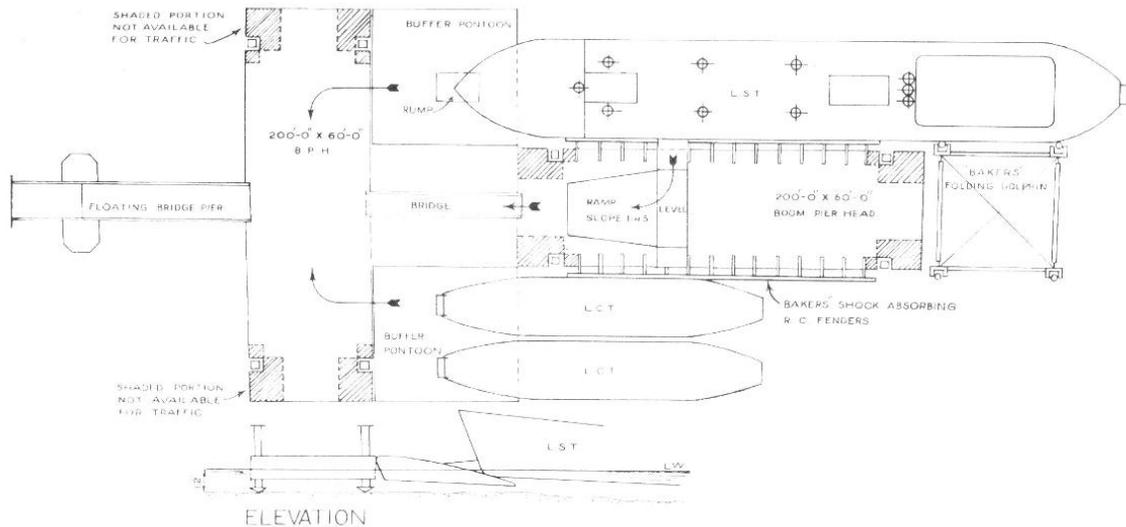


Figure 3. Diagram of Lobnitz Pier

Source: Guy Hartcup, *Code Name Mulberry* (New York: Hippocrene Books Inc., 1977), 51.

American Naval planners became involved in Mulberry planning soon after the Québec conference. The majority of personnel were from the Shipping Control Section of Commander U.S. Naval Forces Europe (ComNavEu) under Captain Howard Flanigan.³³ The Shipping Control Section later became known as ComNavEu Logistics Section and was made up of young Reserve lieutenants and lieutenant commanders. The officers were assigned to the Logistics Section as an additional duty to their normal jobs. The planners of the Logistics Section were indoctrinated into Mulberry and made the harbors their number one priority by 1 November 1943.³⁴ With the arrival of Rear Admiral Alan B.

Kirk as head of U.S. naval invasion forces, the Logistics Section changed its name to Task Force Support Section. The section was now to support Admiral Kirk and Task Force 122, but Kirk in reality worked for the British Naval Commander Expeditionary Forces (ANCXF), not VII Fleet. This was a point of confusion for many at ComNavEu considering that Admiral Stark, commander of ComNavEu outranked Admiral Kirk, but Kirk only answered to ANCXF and Washington.

Admiral Kirk showed no interest in Mulberry. Flanigan, a member of Admiral Stark's staff was still Task Force Support Section's boss. Therefore Mulberry planning would remain a VII Fleet project until Admiral Kirk took Mulberry over operationally at the time of the assault. Kirk appointed Captain Dayton Clark as logistics officer for Task Force 122. Clark had personality conflicts and was in constant clashes with other staff officers on Task Force 122. In the end Clark requested transfer out of the European theater. Admiral Kirk decided to appoint Clark to the command of Mulberry in an effort to both be rid of Captain Clark and Mulberry in one sweeping move.³⁵ The personnel of the Task Force Logistics Section were then loaned by Captain Flanagan from ComNavEu to Clark for further planning and became known as Force Mulberry.

Michael Harris, in his book, *Mulberry: The Return in Triumph*, devotes an entire chapter to Captain Clark called *Ahab and the King*. He refers to Clark as a pain in the neck, and as a stern depressing man, disliked by officers of both the Royal and U.S. navies. Clark was only respected by his own staff due primarily to his work ethic and the staff's own isolation. Other secondary sources are not as blunt about Clark, but insinuate effectively that Clark was a hard person to work with. Harrison drives home the point in *Mulberry: The Return in Triumph*, writing that Captain Clark's "dedication" worked

dangerously to infect his staff with the conviction that they had to work ten times as hard to evade the appalling potentialities of a situation in which their American naval superiors would not help, because they had no faith in Mulberry.³⁶ After all, the Army had requested Mulberry, not the Navy.

There really was not any other qualified officer available to lead Force Mulberry. Few officers in the U.S. Navy wanted the job. Stanford points out in *Force Mulberry* that a wise career-oriented captain would pick any other billet than Commander, Force Mulberry. There was an obvious British dependency.³⁷ There was a general feeling in Task Force 122 that the U.S. Navy had been sold out to the British and Admiral Sir Bertram Ramsay, ANCXF. Any credit for success of Mulberry would be given to the British and any failure of Mulberry would most certainly end a career.

A confused chain of command hampered Force Mulberry beyond that of an overbearing and driving commander such as Clark (See Figure One). Admiral Ramsay, ANCXF, the naval commander for Overlord was British. Beneath Admiral Ramsay was the American Admiral Kirk, who had no interest in Mulberry but was Commander Task Force 122. To make things worse a British naval officer, Rear Admiral William Tennant was designated as commanding officer for both Mulberries A and B with the title Rear Admiral Commanding Mulberry and Pluto (RAM/P).³⁸

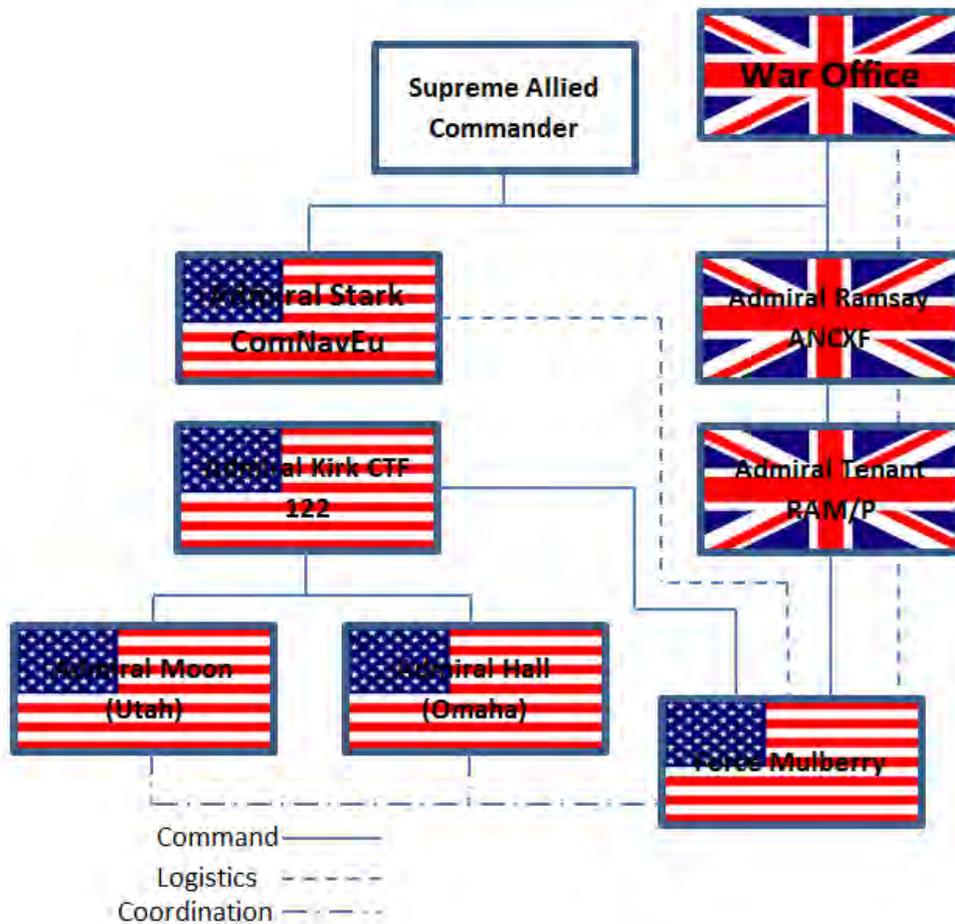


Figure 4. Command Relationships

Source: Created by author.

In order to obtain supplies for his personnel Captain Clark was forced to go through ComNavEu. To obtain supplies and construction material related to Mulberry operations Clark had to go through the War Office which meant going through Admiral Tennant RAM/P, then through Admiral Ramsay, to finally reach the War Office. British War Office was British Army. Clark could only go through Tennant and Ramsay to obtain things from the War Office or for any contact with British civilian supply agencies. Considering the tension between the British War Office (Army) and the

Admiralty (Navy) it is no surprise that Captain Clark had problems in completion of the structures necessary for construction of Mulberry A, the American artificial harbor.

Command relationships were not the only problem for Force Mulberry. Personnel problems persisted throughout the operation. The situation was not surprising considering the lack of support from U.S. Navy senior leaders. In January 1944 a ComNavEu naval officer, sent to Washington for talks with high-ranking officers in the Bureau of Naval Personnel concerning urgently needed officers, was met with this remark: “Mulberry? What the hell kind of ship is the soft fruit class?”³⁹ Fights ensued over available personnel. U.S. Navy Construction Battalion (CB) personnel were assigned only after arguments with Washington and only after the CBs completed other Bolero construction assignments prior to movement to Force Mulberry. Personnel needs in the Pacific theater conflicted with European theater needs and Mulberry was a low priority in Washington Navy circles. In the end Force Mulberry was made up almost entirely of Reserve officer personnel and Navy CBs which Force Mulberry managed to have diverted from their movement to the Pacific after their projects in England had been completed.

Personnel shortages had negative effects on training. The CB situation compounded construction delays, slowing the availability of the structures making up Mulberry, namely the Whale roadways and Phoenix caissons, meaning Force Mulberry went into Overlord largely untrained. Much of the training for operations had to be hands on. As the massive Phoenix caissons were completed and finally moved for “parking” at Selsey Bill, the majority of training Force Mulberry personnel received in placing Phoenixes was when they parked them for temporary storage prior to the invasion.

Beyond the issues of personnel and training there was a distinct lack of planning involvement for Force Mulberry personnel. There was only an ad hoc planning organization in place at VII Fleet for Mulberry prior to January 1944. The Mulberry A layout was actually designed 28 September 1943, long before the Logistics Planning Section of VII Fleet was loaned to Captain Clark. Present on the committee that designed Mulberry A was Commander Allen Stanford U.S. Navy Reserve, who later became deputy commander Mulberry A. Stanford was the only U.S. Navy representative present to later work on Mulberry, The only other U.S. attendee was a U.S. Army Corps of Engineers Colonel and a U.S. Navy Captain, V.E. Korn.⁴⁰ No other record of Captain Korn's involvement with Mulberry can be found. The single meeting produced the entire layout that was to be Mulberry A. (See Figure Two)

Planning for Mulberry A also required consideration for Utah beach. Planners did not have to work out such an elaborate plan for Utah as done for Omaha. Utah beach itself was sheltered from direct gales due to its location on the east side peninsula. Due to this geographic sheltering it was determined that Utah only required two floating pontoon piers. Breakwaters would be necessary for shelter from storms, but valuable Phoenix would not be needed, only Cobb Blockships, or a Gooseberry.

While cooperation between British and American leaders at the higher levels was lacking, at the junior levels, tactical and operational, cooperation was encouraging. Relationships were not without their problems. However, on the whole the American personnel of Mulberry transferred their obedience and loyalty to the British commanders, almost in a spirit of independence from their own top brass. This was partially due to the

American mistrust of U.S. senior leadership and the leadership's obvious dislike of Mulberry.⁴¹

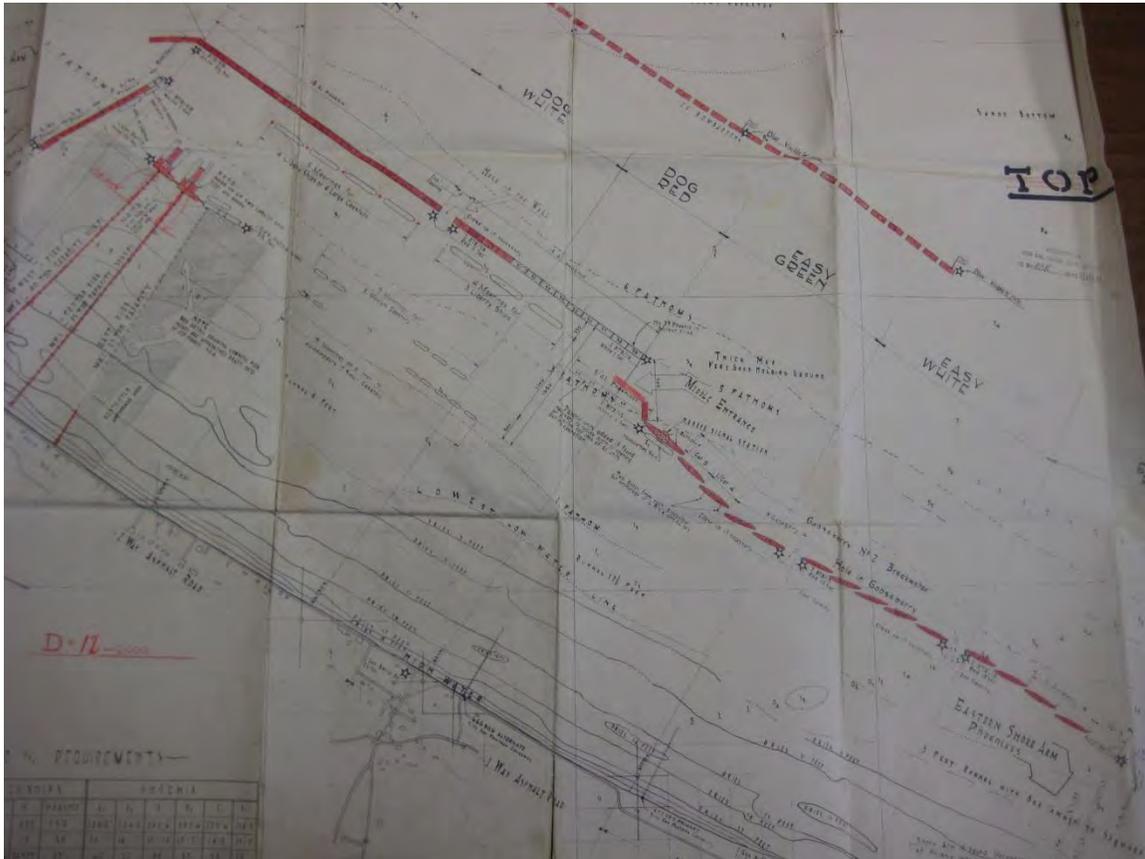


Figure 5. Mulberry A Design

Source: Dayton Clark Papers, Box 1, Port Organization, Mulberry, Dwight D. Eisenhower Presidential Library.

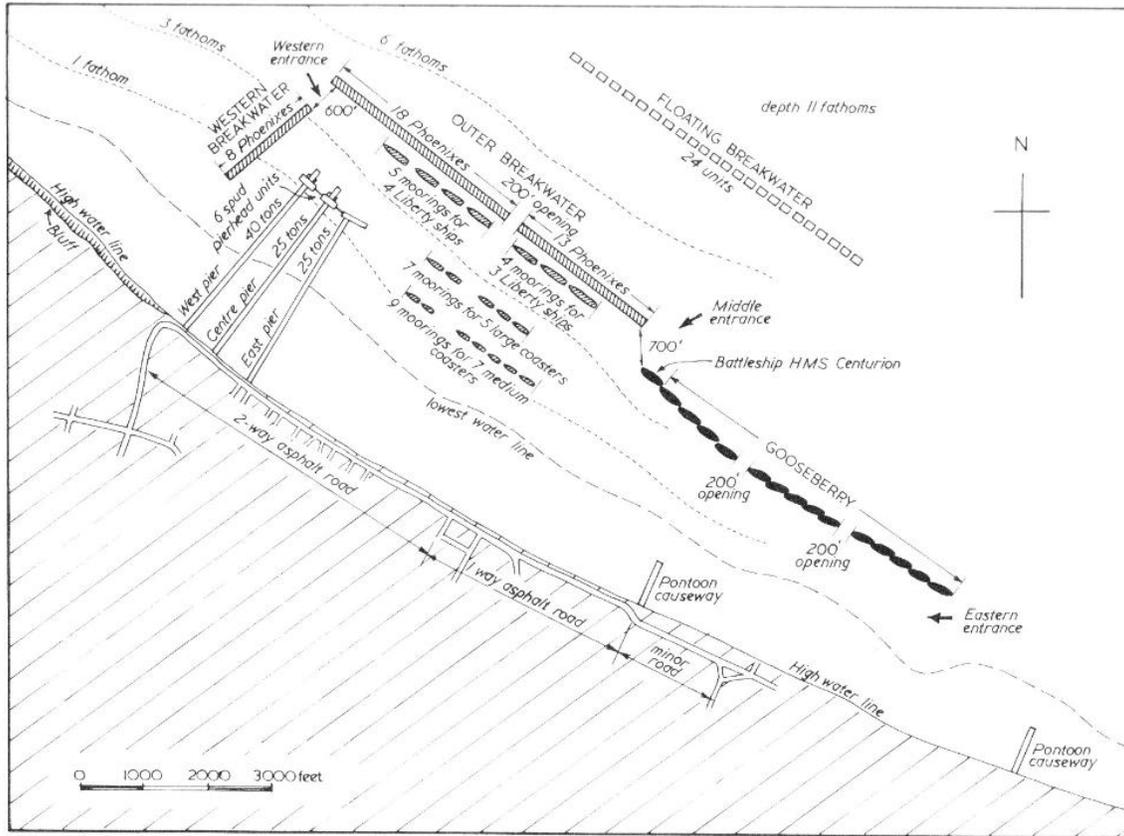


Figure 6. Mulberry A Design (Clear Version)

Source: Guy Hartcup, *Code Name Mulberry* (New York: Hippocrene Books Inc., 1977), 21.

On the whole Mulberry was a British operation. Mulberry conception was British. Mulberry planning and execution were British. The Americans found themselves entirely dependent upon the British for everything related to Mulberry. The only items that the U.S. senior leadership offered for the operation were tug boats. The U.S. promised twenty-five towing vessels. In the end eleven of these arrived unsuitable for the mission. Wernher remarked, “It became apparent that the Americans were quite prepared to leave the main problem of the Harbors to us.”⁴²

There are many factors that create the conditions for a successful amphibious assault, but focus must be on sustainment. A successful opposed amphibious operation consists primarily of arms and all the other necessary material to sustain forces establishing the bridgehead and keeping them reinforced.⁴³ Forces must build-up equally or faster than the opposing force can reinforce. The reasoning behind Mulberry enabled planners to move on to address the other necessary factors.

The plan for Mulberry was not an answer in and of itself, but a key feature of the Overlord operation. Ruppenthal, in *Logistical Support of the Armies*, stated that the problem of logistics support occupied a preeminent place in every discussion.”⁴⁴ At the same time, Mulberry itself was only one stopgap among many other measures. The call for increasing numbers of assault ships is an example. Air drops were planned as needed. The harbors can be looked at as built merely as a backup plan against the weather. Estimates of the over beach logistical operations met the forecasted needs of the divisions ashore and the buildup once additional craft were factored in. The Navy believed it could supply the Army with what it needed, but just barely. What was in doubt was a period greater than four days of good weather. Planners did not believe the attack could withstand a period of bad weather interrupting the beach operations and build-up. A ten year history of weather patterns were studied and the results worried planners. That being said the operation could not have gone any other way. Admiral Hickling, Naval liaison officer to Major General Wernher and later in command at Mulberry B, stated:

To suggest that the invasion might have been carried out in any different way is all rot. The whole COSSAC plan depended on ~~sheltered~~ “water,” and the Army would never have dreamt of landing over open beaches, and putting its buildup at the mercy of the channel whether. No ~~“window dressing”~~ about it. It was the Army that wanted the Gooseberries and the Mulberries, and the Navy did all in

their power to help them. Without them, the operation – as COSSAC planned – would simply not have taken place.⁴⁵

¹Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Headquarters Department of the Army, 2008), 5-11.

²Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944*, 178.

³Michael Harrison, *Mulberry: The Return In Triumph*, 24.

⁴*Ibid.*, 74.

⁵*Ibid.*, 40.

⁶G. Harrison, *The United States Army in WWII, The European Theater of Operations, Cross Channel Attack*, 6.

⁷*Ibid.*, 8.

⁸M. Harrison, *Mulberry: The Return In Triumph* 76.

⁹Stanford, *Force Mulberry*, 39.

¹⁰G. Harrison, *The United States Army in WWII, The European Theater of Operations, Cross Channel Attack*, 54.

¹¹Generalleutnant Max Pemsel, *Fighting the Invasion; The German Army at D-Day*, ed. David C. Isby (London: Lionel Leventhal, 2000), 58.

¹²General der Panzertruppen Leo, Freiherr Geyr von Scheppenburg, *Fighting the Invasion; The German Army at D-Day*, ed. David C. Isby (London: Lionel Leventhal, 2000), 75.

¹³M. Harrison, *Mulberry: The Return In Triumph*, 122.

¹⁴G. Harrison, *The United States Army in WWII, The European Theater of Operations, Cross Channel Attack*, 56.

¹⁵Hartcup, *Code Name Mulberry*, 16.

¹⁶*Ibid.*, 30.

¹⁷Churchill, Winston. *Closing the Ring*. (Cambridge: Houghton Mifflin Company Boston, 1951), 73.

¹⁸Roy Walter, *A Harbour Goes to War: The Story of Mulberry and the Men Who Made it Happen*, ed. Elizabeth Palmer, Jane Evans, and R. Walter (Glasgow: South Machars Historical Society, 2000), 6.

¹⁹*Ibid.*, 6.

²⁰Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944*, 176.

²¹*Ibid.*, 81.

²²G. Harrison, *The United States Army in WWII, The European Theater of Operations, Cross Channel Attack*, 71.

²³*Ibid.*, 73.

²⁴Ruppenthal, 182.

²⁵M. Harrison, *Mulberry: The Return In Triumph*, 173.

²⁶*Ibid.*, 98.

²⁷*Ibid.*, 134.

²⁸*Ibid.*, 136.

²⁹Walter, *A Harbour Goes to War: The Story of Mulberry and the Men Who Made it Happen*, 12.

³⁰*Ibid.*, 82.

³¹M. Harrison, *Mulberry: The Return In Triumph*, 103.

³²*Ibid.*, 254.

³³Stanford, *Force Mulberry*, 50.

³⁴*Ibid.*, 52.

³⁵*Ibid.*, 56-57.

³⁶M. Harrison, *Mulberry: The Return In Triumph*, 237.

³⁷*Ibid.*, 55

³⁸Stanford, *Force Mulberry*, 58.

³⁹*Ibid.*, 47.

⁴⁰M. Harrison, *Mulberry: The Return In Triumph*, 198.

⁴¹*Ibid.*, 195.

⁴²*Ibid.*, 193.

⁴³G. Harrison, *The United States Army in WWII, The European Theater of Operations, Cross Channel Attack*, 88.

⁴⁴Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944*, 181.

⁴⁵M. Harrison, *Mulberry: The Return In Triumph*, 87

CHAPTER 4

MULBERRY A OPERATIONS

For the Mulberry men, June of 1944 came all too quickly. The time had arrived to put into practice all that Force Mulberry had trained for and to operationally deploy the technological innovation in amphibious warfare they had worked on so diligently. The Germans could not have overlooked what the Allies were preparing for and planned to accomplish. Any engineer could look at photographs of the massive Phoenix caissons at Selsey Bill and other locations and surmise precisely what they were intended for. In fact, in a propaganda radio broadcast weeks before the invasion, William Joyce, the personality known to the Allies as Lord Haw-Haw, addressed the men of Force Mulberry directly. “We know,” said Joyce, “exactly what you intend to do with those concrete caissons: you intend to sink them off our coast in the assault. Well, we’re going to help you, boys! We’ll save you some trouble. When you come to get underway, we’re going to sink them for you.”¹

Of particular concern to Task Force 128 were the five German destroyers and eleven torpedo boats known to patrol the English Channel. With his broadcast Lord Haw-Haw caused much distress to the task force personnel. The Germans had stated they knew what Mulberry was, they knew where Mulberry was, and intended to sink the massive caissons when the attempt was made to cross the channel. Traveling aboard a six-story block of concrete at 3 knots probably was not the most enjoyable ride, knowing the danger lurking.

Pre-invasion intelligence briefings in early June did not give the personnel of Task Force 128 any more comfort about what lay ahead. Sustaining the force was Force

Mulberry's responsibility and Force Mulberry had to build faster than the Germans could mobilize to counterattack. Captain Dayton Clark received word that estimates of the number of German divisions available in Western Europe to counter the Allied invasion in France had risen from fifty-three to over sixty divisions. Clark learned that six Allied infantry divisions and two airborne divisions would immediately face two Panzer divisions in the direct invasion area.² The Allied plan was to have a total of thirteen divisions on shore by D+3. According to the early June briefing received by Captain Clark, intelligence estimated that the Allies would face eighteen to twenty German divisions by D+3.³ Clark had his mission, knew how much depended on him and his men, and was driven to succeed. Clark's men would accomplish the mission no matter what the cost.

On 4 June 1944 General Eisenhower delayed the invasion from 5 June to 6 June due to the weather. Captain Clark was advised of the weather delay and finalized preparations to be on the coast the morning of 7 June. The groundwork of staff and personnel moving to the far shore was complete by 5 June and Captain Clark and his deputy, Commander Alfred Stanford, U.S. Navy Reserve, embarked on small convoy escort ships, as part of convoy EWC1A sailing from England. The convoy was to arrive at Normandy at 0600 D+1.⁴ After reporting to the Western Task Force commander, Captain Clark and his deputy immediately set to work on the surveys for the Gooseberry at Omaha and Utah beaches. By noon that first day the first block ships, code named Cobs, arrived and three of the ships comprising the Utah Gooseberry were sited under fire from shore batteries, resulting in ten casualties.⁵ The Gooseberries were derelict ships sunk in shallow water in a row, sheltering small craft from wave action. Sinking block

ships for the Gooseberry at Utah Beach would be completed over the next four days (D+5).⁶



Figure 7. Gooseberry Blockships at Omaha

Source: Walter Bedell Smith, Collection of World War II Documents 1941-1945, Box 48, Amphibious Operations, Northern France Western Task Force, June 1944, Dwight D. Eisenhower Presidential Library

The problematic raising of the Phoenixes on the near shore by Royal Navy engineers had begun the week prior and was well underway. The raising of the Phoenix was a massive undertaking. The structures were the primary breakwater for the two

harbors and some were as tall as five stories. Phoenix personnel began towing the Phoenixes out of Selsey Bill and other locations on the channel coast for the thirty-hour tow across to Normandy on 5 June. In spite of Lord Haw-Haw's prediction, only three Phoenixes were lost on the journey, one torpedoed, another sunk by an E-boat, the third Phoenix was lost to a mine. Additionally, Whale number 528, the bridging sections that comprised the floating roadway, was picked up adrift but with no sign of its thirty accompanying personnel other than blood (the crew was believed to be machine gunned by an e-boat).⁷ The bad weather protected the lives and equipment of the Mulberry. The storm and high seas during the crossing confined most of the German patrols to the safety of the harbor; the Germans didn't believe an invasion fleet would approach in rough seas.

The men of Task Force 128 faced a myriad of problems upon arrival at the far shore. Mulberry ships worked under constant fire from shore batteries. HMS *Minster*, one of Force Mulberry's survey ships, struck a mine and went to the bottom with all hands. Even with the difficulties, work progressed ahead of schedule. The men of Task Force 128 were driven by Captain Clark, constantly and even inhumanly at times. Clark never appeared to sleep more than three or four hours a night. Men were driven to the edge by exhaustion and constant badgering by Clark. By D+5 all Cob block ships were in place at the Utah Gooseberry and construction of one 2,400 foot pontoon causeway completed.⁸ Additionally the Bombardons, floating plate steel crosses designed to break wave action in deep water, were nearly complete with twenty moorings in place and fourteen of the units in position.⁹ Work started on siting the Lobnitz pier-heads west and middle for the main harbor at Omaha. The task force sited twelve of the fifty-one planned Phoenix caissons on the ocean floor.¹⁰

By D+2 the logistics gap already loomed large. Army commanders insisted that the Navy attempt beaching an LST to make up for poor output over the beaches. With the shelter breakwater partially complete engineers onshore were able to remove many of the runnels and sandbars while the water was at its lowest point. Normandy beach had a four knot current causing these runnels, sandbars, and shifting sands, but with the beach sheltered from the current by the Gooseberries, the sand needed only minor maintenance from D+2 onward. The success of the harbor Gooseberry contributed to the success of the first beaching of an LST. Originally the Navy had feared damaging its valuable LSTs. Normandy beach and its troughs and sandbars combined with the wave action could break the back of the heavy ships. The Navy begrudgingly agreed to experiment and with the successful beaching of the first LST on D+2, the practice became standard. Over one hundred LST's were beached in the first two weeks.

At this point there was absolutely no doubt that the Germans knew exactly what Force Mulberry was constructing. The Luftwaffe attempted to mine the harbor from the air on multiple nights while the Mulberry assembly was underway¹¹. Though not successful, the attempts demonstrated German concern and focus, if not desperation. Very few Luftwaffe sorties were attempted during the entire Normandy invasion. The fact they attempted to mine the sheltered harbors at both Utah and Omaha with the few resources and little fuel available to them is telling.

The problems were not just German shore batteries, aircraft, and mines. A self-inflicted problem surfaced. The plan called for the assembly of three Whale bridges. Two of the Whale bridges were designated for trucks and lighter vehicles twenty-five tons or less. The third bridge was specifically designed for battle loaded Sherman tanks and their

thirty-eight ton weight. During construction there was a shortage of raw material in England, especially steel. The Bombardons were made entirely of steel and all available ore was directed towards their construction. Due to the steel shortage the concrete pontoons floating the Whale bridging could not be reinforced. Instead the floats were constructed primarily of cast concrete. The rough crossing of the English Channel may have saved lives and materiel from German patrol boats, but many of the concrete pontoons cracked and sank. In the end there were not enough pontoons to construct all three bridges to Omaha beach. Most importantly not enough pontoons rated for the forty ton bridge survived and it appeared Mulberry was on the brink of failure.

The Mulberry men came up with the only option available to them. The task force would cannibalize one of the planned twenty-five ton truck bridges and alternate the surviving forty ton rated tank pontoons with the cannibalized twenty-five ton truck pontoons. Force Mulberry didn't know if the plan would work, and if not, LSTs loaded with tanks would have to be beached. Work continued even with the misgivings as to whether Mulberry would work at all.

On D+7 four more Phoenix caissons added 800 feet to the sheltered breakwater of the Omaha Gooseberry. Five more caissons were sunk by D+9, with the final Phoenix dropped in place on D+10 completing the sheltered breakwater.¹² D+10 marked the beginning of operations at Mulberry A, three full days ahead of schedule.

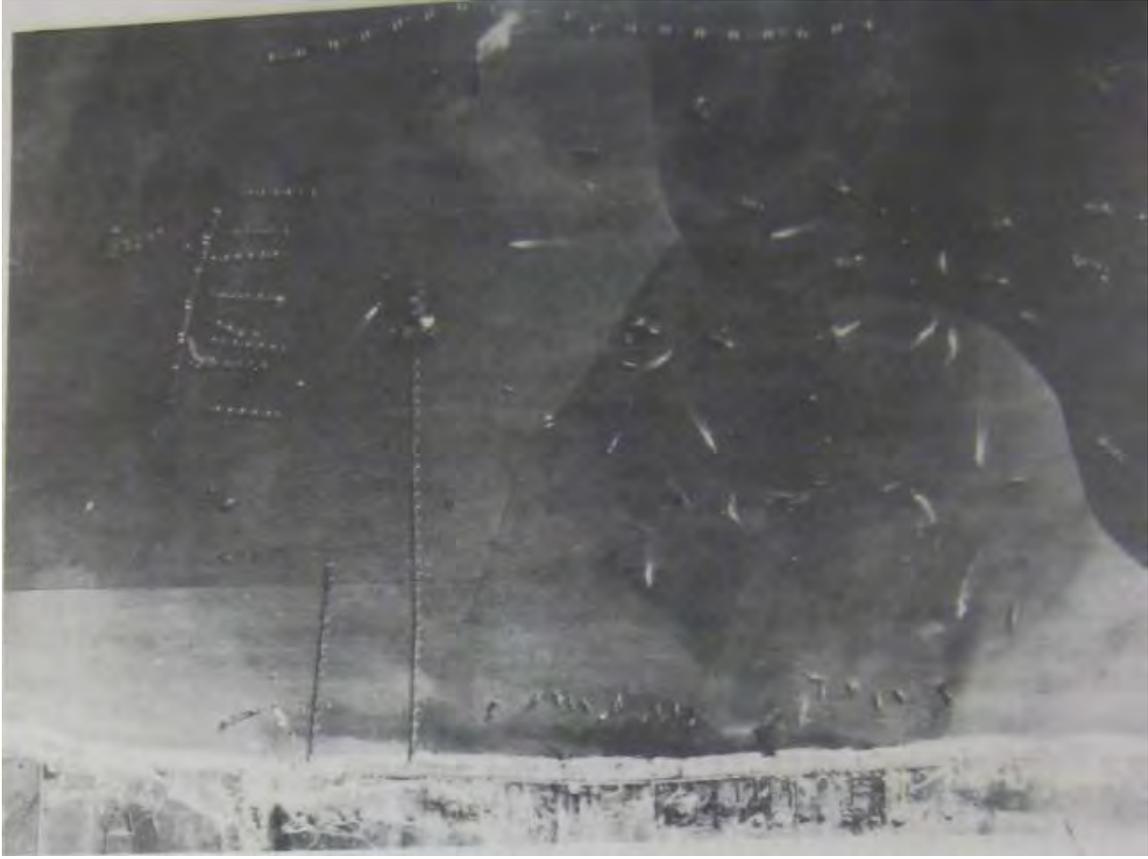


Figure 8. Mulberry A From Above, 15 June 1944

Source: Walter Bedell Smith, Collection of World War II Documents 1941-1945, Box 48, Amphibious Operations, Northern France Western Task Force, June 1944, Dwight D. Eisenhower Presidential Library

On 16 June (D+10), LST 342 nosed up along the T formed by two Lobnitz piers at the end of the center whale roadway.¹³ Army and Navy men gathered and watched as the LST ground on the floating buffer pontoon and the doors opened. The first vehicle emerged and went up the ramp of the buffer pontoon and turned onto the Whale roadway. The cannibalized bridge made for some harrowing moments as the first Sherman tank rolled across the compromised whale. The first attempt was with a single tank on the bridge. The margin for error on the overtaxed pontoons was slim and the twenty-five ton

pontoons nearly submerged completely under the weight of the tank leaving only a three inch leeway. The concept worked as long as the Sherman tanks remained a minimum of 160 feet apart on the crossing and traveled no faster than five miles per hour. While offloading multiple tanks all the vehicles needed to be directly over the Beetles (actual float under the Whale roadway) simultaneously; if any of the Sherman tanks fell behind or raced ahead it would have been disaster; but it worked. In thirty-eight minutes, seventy-eight vehicles had been discharged, and LST 342 was ready for the return trip to the United Kingdom.¹⁴ The wartime, under fire, artificial harbor experiment was a success. An LST was completely unloaded in less than forty minutes using a single operational Whale roadway.

The operational pier-head at Mulberry A effectively doubled the lift to the beaches. Until Mulberry A was operational LSTs used an exorbitant amount of time to beach themselves at high tide, wait for the tide to recede, unload, and wait for the tide to return in order to be pulled off the beach and start the return trip to the United Kingdom. The entire process took approximately twelve hours. Instead of wasting a precious twelve hours grounded on the beach waiting for the tide to return, Mulberry A enabled an LST to return to the United Kingdom, reload, and be half-way back to France on a second trip before the tide had returned and a grounded LST had pulled itself off the beach.¹⁵ In the table below note the tonnage for the first ten days of operations while LST's beached and cargo ships were offloaded using ferries and smaller craft.

Table 2. Tonnage Over the Beaches			
D-Day	Date	Omaha	Utah
	June 6		
D+1	7		
D+2	8	1429	4378(includes D+1)
D+3	9	2542	3163
D+4	10	3942	2398
D+5	11	7187	2265
D+6	12	5752	4144
D+7	13	5461	3839
D+8	14	7377	4958
D+9	15	9008	5736

Source: Alfred Stanford, *Force Mulberry* (New York: William Morrow and Company, 1951), 229. Note: No data available for 6-7 June.

In table 2 take note of the dates 16-19 June. These dates mark operation of the Mulberry A and its use of its single whale roadway. The marked fall off in tonnage at D+13 represents the June 20 to 22 gale that brought supply operations to a near halt. It must be pointed out that an anomaly exists with the tonnage brought over the beaches at D+9, 15 June. A total of 9008 tons were moved over Omaha beach. This jump in tonnage prior to pier operations cannot be directly accounted for in the available record. It can be surmised that the stores piers planned for were operational at this point and DUKWs were running at full capacity offloading cargo ships over the stores piers.

Table 3. Tonnage From Beginning of Port Operations			
D-Day	Date	Omaha	Utah
D+10(Day 1 of Ops)	June 16	8535	5931
D+11	17	8876	4784
D+12	18	8690	5670
D+13	19	5764	2575
D+14	20	676	323
D+15	21	1077	481
D+16	22	494	865
D+17	23	9996	6399
D+18	24	11,562	5959
D+19	25	12,994	7142
D+20(Cherbourg Falls)	26	14,449	6898
D+21	27	12,808	6891
D+22	28	13,842	8670
D+23	29	14,869	8171
D+24	30	14,361	6496

Source: Alfred Stanford, *Force Mulberry* (New York: William Morrow and Company, 1951), 229.

The operational opening of Mulberry A was very important to the Allies. Leadership identified by D+1 that over-the-beach logistics were not providing the tonnage required and previously planned. During the initial assault landing craft beached upon sandbars and discharged soldiers in six to ten feet of water, many soldiers drowned when stepping off the landing craft fully loaded with combat equipment. This practice continued later in the assault and into D+1, but with trucks, not with soldiers. Landing craft operators thought they were in shallow water, but in fact were on a sand bar. The Special Engineer Brigade responsible for Omaha beach logistics lost forty-two trucks in the first two days mainly to the drowning of vehicles.¹⁶ Prior to the opening of Mulberry A, deliveries were falling seriously behind projections and senior leaders worried that

combat operations would soon be affected. Compounding problems, during the assault the Allies lost over 100 LCVPs and LCMs, and 2 LCTs. The offloading of cargo ships was slowed due to the fact that of the twenty Rhino ferries only two remained operational.¹⁷ (Rhino ferries were a U.S. contribution to Mulberry consisting of large rafts formed by multiple pontoons propelled by outboard motors capable of carrying large amounts of supplies and vehicles.) The invasion was in danger of failing logistically. The operational Mulberry represented an opportunity to close the gap. By 18 June (D+12) the combined daily discharges at the two beaches were averaging approximately 14,500 tons which was only slightly below expectations¹⁸ (see tables 2 and 3). The logistics gap had not yet been closed, but leaders were encouraged that delivery targets would soon be exceeded. With the other two planned roadways nearing completion and the remaining Lobnitz piers in place four to six LST's at one time could be berthed and simultaneously discharge vehicles to the beach.¹⁹ These expectations were not to be met.

Table 4. LST Offload Times

Ship	Time Docked	Time Out	Time In Dock	No Vehicles Discharged	Time of Discharge
LST 342	1643	1800	0117	78	38 min
LST 427	1813	2005	0152	48	53 min
LST 301	2023	2133	0110	54	51 min
LST 345	2153	0050	0253	55	93 min
LST 288	0720	0915	0155	43	61 min
LST 285	0945	1115	0130	46	57 min
LST 324	1135	1410	0235	42	59 min
LST 316	1320	1500	0140	38	50 min
LST 423	1425	1520	0055	56	39 min
LST 357	1510	1605	0055	22	47 min
LST 47	1540	1745	0205	47	66 min

Source: 17 June Log; Memorandum from Commander Task Force 128 to Commander in Chief, U.S. Fleet, Subject: War Diary of TF 128—forwarding of, 11 August 1944, Dayton Clark Papers, Box 1, Dwight D. Eisenhower Presidential Library.

By 18 June (D+ 12) the second whale roadway, twenty-five ton design, was completed. Unloading speed increased with two strings of vehicles. Tanks and trucks were unloaded simultaneously. The 18th of June marked the end of floating roadway installations, but there were not enough surviving Whale pontoons available to complete the third planned causeway. Nonetheless, Mulberry A was fully operational and running without incident and as planned. Additional pier-heads and other jobs still remained, but up to six LSTs could be worked simultaneously, and that was the goal.

In combination, the beaching of LSTs, and two operational causeways, the logistics gap looked to be filled soon and logistics personnel had good reason to be optimistic. Admiral Tennant had expressed doubts to Captain Clark about the usefulness of the whole Mulberry idea and had expressed great skepticism that Mulberry could ever be completed even in thirty days much less the planned twelve.²⁰ With the successful operations, even Tennant became an optimist and the plan for winterizing the harbor was talked about at high levels. The U.S. Navy had finally been convinced that Mulberry was at least useful. The U.S. Navy asked for new drawings and plans were put into motion to construct additional Phoenix caissons to be double banked against winter storms. But the Mulberry's luck was about to run out and the weather was about to change.²¹

On 18 June the Western Whale roadway was completed to its Western Lobnitz pier, and that Lobnitz connected with the pier which terminated the center roadway. The work on 18 June was completed under darkening storm clouds. Mulberry personnel became anxious about the cold shift in the winds, and asked ComNavEu for additional weather reports. The returned reports insisted the visibility on 19 June would be four to six miles with wind velocity only 8 to 13 knots, and a ceiling of 2 to 3000 feet.²²

By the morning of 19 June wave action was nearly over the Phoenix walls. That afternoon winds of thirty knots forced Mulberry work to be stopped when two DUKW craft were swamped. Noticeable seas of three feet high were racing through the inner sheltered harbor now and some of the moorings and temporary bridging began to part. The majority of the craft inside the harbor were small beaching craft. Beaching craft were designed to be anchored from the stern, a design flaw that was soon to doom the Mulberry harbor. The design aided the landing craft in retracting after beaching themselves but it also made them difficult to tie down in rough weather. Countless small craft were soon out of control within the harbor or ran out of fuel fighting the currents once they broke loose. Landing craft either ended up on the beach or in one of the two completed Whale roadways. Orders went out on the first night ordering all arriving ships to return to England or ride out the storm in the channel. Many of the small craft had no choice but to remain in the harbor and attempt to ride out the storm in the small sheltered area. Seas were already over the Phoenix walls and by nightfall on the 20 June the storm was at full force. During the night a U.S. salvage barge and five British LCTs drifted in against the eastern side of the center Whale roadway. Their heavy steel hulls destroyed every object they ran into. They cracked the concrete pontoons and crushed the steel. The Whale bridging gave way and turned on its side in a mass.²³

The storm continued through the night of 21 June and is said to be the worst June gale in forty years.²⁴ Additional shipping buffeted by strong winds and heavy seas continued to drift down against the piers and roadways. Phoenixes in the outer breakwater showed signs of collapse and the Lobnitz pier-heads gave indications of breaking up in the heavy seas, making it necessary to evacuate personnel. The

Bombardons broke their moorings and all twenty-four steel masses went adrift.²⁵ The Bombardons inflicted an enormous amount of damage to the harbor roadways and piers. The Bombardons were masses of floating steel, and free of their moorings they broke through the concrete Phoenix caissons destroying them and became battering rams inside the harbor.

The men of task force 128 surveyed the damage on June 23. In addition to severe damage to the Whale equipment, the near complete destruction of the Phoenix breakwater, and the loss of all 24 bombardons, seven of the block ships of the Omaha Gooseberry had broken backs as a result of the storm.²⁶ The Gooseberry at Utah beach was largely sheltered from the storm against the peninsula. All the Mulberry material in transit during the storm was lost. The Whale bridging could be replaced but the bridging would require new material from England. Of 650 LCTs, only 330 had survived. The situation appeared to be desperate.



Figure 9. Mulberry A From Above 23 June 1944

Source: Walter Bedell Smith, Collection of World War II Documents 1941-1945, Box 48, Amphibious Operations, Northern France Western Task Force, June 1944, Dwight D. Eisenhower Presidential Library

All was not lost to the storm. Fifty percent of the Phoenix breakwaters remained intact as did the majority of the block ships comprising the two Gooseberries. Perhaps most importantly the DUKWs survived almost in their entirety because they rode the storm out parked on the beaches. A total of three DUKWs were swamped in the heavy churn of the harbor preceding the storm, but once operations were halted, the remaining vehicles were parked safely on the beaches.

Captain Edward Ellsberg arrived from Selsey Bill immediately after the storm. Captain Clark requested Ellsberg's assessment as to whether or not the Lobnitz pier-heads were functional, and if not what in manpower and material would get them working again. Previously, Ellsberg was instrumental in re-floating the phoenixes stuck in the mud at Selsey Bill. Ellsberg was somewhat of a celebrity expert salvage officer, responsible for the raising of U.S. Submarine S-51 and was later nearly killed in the rescue efforts of Submarine S-4. Ellsberg was intimately familiar with the equipment used in the construction of the Mulberry harbor due to his work at Selsey Bill. Originally the Mulberry plan consisted of six pier-heads and three roadways. After his assessment Ellsberg determined that enough material remained salvageable to reconstruct two roadways and repair one or two pier-heads. Combined with parts yet to be delivered from England, Ellsberg believed Mulberry A could be operational again inside of a month. The goal was to return to the proven original forty to sixty minute turnaround time for an LST vs. the twelve hours required to turn around a beached LST.

Clark took Ellsberg's assessment to Admiral Kirk and was promptly rebuffed. Ellsberg was a member of Admiral Stark's staff and had the status as a visiting officer, thus his advice to Captain Clark was unofficial. The salvage officer in charge, Commodore W. A. Sullivan, had taken a brief trip down the beach and decided salvage of Mulberry A was not possible.²⁷ The Commander Western Task Force and Rear Admiral Mulberry/PLUTO decided the Omaha Gooseberry would be reinforced with twelve additional block ships and only the twenty-five ton bridging and pier would be salvaged²⁸. Bridging for the forty ton pier would be turned over to the British for use in Mulberry B.²⁹ Cherbourg would fall within days; the harbor at Cherbourg would be

operational within a week and Mulberry A would no longer be needed. The harbor machinery would be abandoned in lieu of the proven Gooseberry, which was to be strengthened.

Cherbourg eventually fell, well past schedule at D+20, but the destruction by the Germans was nearly complete. The Germans so effectively mined the harbor that engineers estimated repairs would take months. After a month Cherbourg would only be partially operational. A report by Army Engineers stated, "The demolition of the port of Cherbourg is a masterful job, beyond a doubt the most complete, intensive, and best planned demolition in history."³⁰

The abandonment of Mulberry A was a rash decision. Later in the fall of 1944 a shipping crisis developed, due largely to the number of ships waiting to be off-loaded in the European Theater. Ships were piling up on the coast of France, some partially unloaded and forced to wait, effectively becoming floating warehouses. The problem was caused by lack of sufficient port facilities. In response to pressures from Washington, Lieutenant General John Lee insisted that ship unloading would improve with opening LeHavre and Rouen in France, Antwerp in Belgium, and the transfer of the artificial harbor, Mulberry B, from British to American hands.³¹

The fact remained however that over 19-22 June the levels of supply had become dangerously low. Very little shipping had been offloaded during the storm and the harbor was experiencing a backlog of ships that rode out the weather in the channel waiting for the piers to open. In the days before the storm personnel had managed a supply buildup of seventy-two percent of the projected need. By 20 June the buildup had fallen to fifty-seven percent of projected output.³² The Army's ammunition supplies were nearing

emergency levels and Army leadership called for ammunition regardless of the damage to the ships.

The DUKWs, safely parked on land during the gale were intact and went to work immediately after the storm. The breakwater in the harbor was still effective and this enabled the DUKWs to offload the waiting ships at a frenzied pace. While the versatile DUKWs worked, shore personnel cut open damaged craft with cutting torches to get to ammunition stored inside. Coasters beached themselves contrary to their design. On 24 June, due largely to the unexpected DUKW workhorse and the beaching of ships disregarding damage, tonnage exceeded 11,000 tons, on 25 June nearly 13,000 tons, and 26 June 14,500 tons.

Overall the logistics of Mulberry ran better than expected in spite of the storm disaster. The original thought was that Allied forces would be just barely hanging on and Mulberry would only just enable them enough to save operational forces from logistical culmination. The reality of the situation was encouraging, maybe even better than the skeptics had hoped.

Over beach operations were apparently so effective and leadership so enamored by the positive numbers, that by the end of June tactical decisions were being made without regard to logistical realities. The capture of the Brittany ports was delayed as efforts eastward took precedent. Opportunities at the Seine following the Avranches breakout led to major tactical success, but caused further strain on the lines of communication through August and September. U.S. forces continued make it a practice to ignore logistical implications in decision making. The success in beaching craft through July and August was encouraging, but the situation was not deeply considered.

Senior leaders did not examine in detail what effects the abandonment of Mulberry A would have on the carefully laid out plan of support, namely the timing of shipping over the coming months. The plan of support depended on the timely capture of ports. The pre-invasion estimates of captured port output was overly optimistic and the reality of the smashed ports' capabilities sobering. Compounding this would be the tactical commanders' continued disregard of the original plan of support and the overstretching of the lines of communication through September, precisely when weather would begin to have lasting effects on over beach logistics. Supply was proceeding smartly only on the surface, but beaching of LSTs slowed the scheduled return of shipping to the UK. This in turn caused a severe backlog at the ports in the UK supplying the invasion, and over time contributed to the shipping crisis in the theater. The crisis threatened to endanger supply operations in other theaters, such as the pending invasion of Leyte and Luzon in the Philippines.³³

The reality was that Omaha and Utah beaches were not yet close to the planned output for the end of July. Following the storm, the beaches had only just reached or exceeded planned daily output, but when the port situation is taken into account leadership was overly enthusiastic toward such performance. Cherbourg and other ports were to have been opened by the end of June, but in the end Cherbourg made no contribution to supplying the troops until August. At the end of July the Allies were 30 percent behind in build-up.³⁴ The over-the-beach supply remained an unexpected surprise and from August to September Utah and Omaha met or exceeded projections, but lack of sufficient port facilities appeared to be ignored in the tactical decision to turn east. The

Brittany ports were forgotten. The decision's consequences would later surface in dangerous supply shortages in the coming months.

Without ceremony, and with the looming realities of the situation ignored, Task Force 128 was finished and Mulberry A abandoned. Captain Ellsberg was officially attached on orders, but not to rebuild, only to oversee salvage and movement of material to Mulberry B. Admiral Kirk's staff was never fully behind the Mulberry operation. Few arguments would have convinced many on Kirk's staff to reconsider; the preconceived notions of the staff were too powerful. Personality and internal politics overcame rational consideration. Clark had ruffled too many feathers over the previous year.

The Mulberry design was sound. The destruction of the piers and roadway during the June gale were not due to design flaws, but the destructive energy of small shipping and the Bombardons. The Gooseberries were a proven commodity without the Bombardons and continued to provide protection through the remainder of beach operations. The piers and roadways could stand up under strain from a storm force 8 in magnitude. Mulberry A would not have a chance to prove its worth in any form other than the valuable breakwater.

¹M. Harrison, *Mulberry: The Return in Triumph*, 245.

²Stanford, *Force Mulberry*, 122.

³Ibid.

⁴Memorandum from Commander Task Force 128 to Commander in Chief, US Fleet, Subject: War Diary of TF 128—forwarding of, August 11, 1944, Dayton Clark Papers, Box 1, Dwight D. Eisenhower Presidential Library.

⁵Ibid.

⁶Stanford, *Force Mulberry*, 149.

⁷Ellsberg, *The Far Shore*, 300.

⁸Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944*, 404.

⁹Stanford, *Force Mulberry*, 161.

¹⁰Memorandum from Commander Task Force 128 to Commander in Chief, US Fleet, Subject: War Diary of TF 128—forwarding of, August 11, 1944, Dayton Clark Papers, Box 1, Dwight D. Eisenhower Presidential Library.

¹¹*Ibid.*

¹²Stanford, *Force Mulberry*, 172.

¹³The reality was there would not be three roadways, damage to the pontoons on the voyage necessitated cannibalizing the third roadway.

¹⁴Stanford, *Force Mulberry*, 173.

¹⁵*Ibid.*, 173.

¹⁶Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944*, 396.

¹⁷*Ibid.*, 407.

¹⁸*Ibid.*, 404.

¹⁹Stanford, *Force Mulberry*, 173.

²⁰*Ibid.*, 164.

²¹*Ibid.*, 176.

²²Alfred. Stanford, *Force Mulberry* (New York: William Morrow and Company, 1951), 181.

²³*Ibid.*, 184.

²⁴*Ibid.*, 195.

²⁵Memorandum from Commander Task Force 128 to Commander in Chief, US Fleet, Subject: War Diary of TF 128—forwarding of, August 11, 1944, Dayton Clark Papers, Box 1, Dwight D. Eisenhower Presidential Library.

²⁶*Ibid.*

²⁷Hartcup, *Code Name Mulberry*, 129.

²⁸Later this too would be directed to Mulberry B; Alfred Stanford, *Force Mulberry* (New York: William Morrow and Company, 1951), 197.

²⁹Memorandum from Commander Task Force 128 to Commander in Chief, US Fleet, Subject: War Diary of TF 128—forwarding of, August 11, 1944, Dayton Clark Papers, Box 1, Dwight D. Eisenhower Presidential Library.

³⁰Ellsberg, *The Far Shore*, 350.

³¹John Kennedy Ohl, *Supplying the Troops: General Somervell and American Logistics in WWII* (Dekalb: Northern Illinois University Press, 1994), 235.

³²Roland G Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944* (Washington, DC: Center of Military History, United States Army, 1953), 407.

³³Ohl, *Supplying the Troops: General Somervell and American Logistics in WWII*, 231.

³⁴Ruppenthal, *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944*, 419. Ellsberg had assessed that Mulberry A could be operational within a month after the storm; if Task Force 128 had been allowed to restore the Mulberry it may have been operational at this point.

CHAPTER 5

CONCLUSIONS

No assessment of Mulberry A effectiveness can be completed without discussing what risk means in a military operation. Army Field manual 3-0, *Operations*, explains, when commanders accept risk they create opportunities to seize, retain, and exploit the initiative and achieve decisive results.¹ In Overlord the risk from the lodgment through breakout phases was essentially one million men and their combat equipment. If lost and pushed back into the sea by the German counterattack the results would have been devastating.

Commanders must decide how much risk to accept, and minimize the effects of accepted risk by establishing control measures to mitigate those risks.² There were various operations surrounding Overlord that tactically mitigated risk. Deception operations and feints were employed. What operation Mulberry gave commanders was logistical risk mitigation. The decision to assault over beaches was a massive risk, too large to chance on the quirky channel weather. Risk, uncertainty, and chance are present in all military operations but without such risk mitigating factors as Mulberry, the decision to embark on the cross channel assault could not have been made and most certainly would not have been accepted by the President and Prime Minister. The willingness to incur risk is often the key to exposing enemy weaknesses that the enemy considers beyond friendly reach.³ Over the beach logistics, in the German's eyes was an impossibility without port support. Mulberry was a key enabler that was to allow the Allies to expose German weaknesses.

When considering the effect Mulberry had on operation Overlord one small factor cannot be discounted. Mulberry enabled the decision to move forward with the operation Overlord. Under the resource constraints of 1942 such risk mitigation was the only answer for an assault over the beaches. The Germans did not foresee or suspect the invention and readying of an artificial harbor. The German General Staff were caught unaware by the project, and made no defensive plan for the reality.⁴

Operation Mulberry is an easy target for criticism. What is difficult is looking past the performance based assessments of the individual operation and focusing on the overall effect the operation had in supporting Overlord. Foremost in the mind of critics is that operations only lasted a total of three days and in the end, the piers and roadways were abandoned after the storm of 19 to 22 June 1944. In assessing the success of Mulberry operations the factor that cannot be discounted is the effect of the Gooseberry and Phoenix breakwater on the overall logistics operation. A simple method to assess the value of operation Mulberry is by using modern U.S. Army assessment techniques.

In current Army operations, assessment is a key component of the operational process. The U.S. Army has a formal assessment process using what are known as measures of performance (MOP), and measures of effectiveness (MOE). U.S. Army Field Manual 5-0 defines a Measure of Performance (MOP) as a criterion used to assess friendly actions that is tied to measuring task accomplishment. Measures of performance answer the question, “Was the task or action performed as the commander intended?” A measure of performance confirms or denies that a unit has performed a task properly. A line of effort in an operation has multiple MOPs.⁵ The next assessment level after performance objectives are Measures of Effectiveness (MOE) which are a criterion used

to assess changes in system behavior, capability, or operational environment that is tied to measuring the attainment of an end state, achievement of an objective, or creation of an effect. Measures of effectiveness focus on the results or consequences of actions taken. They answer the question, “Is the force doing the right things, or are additional or alternative actions required?” A measure of effectiveness provides a benchmark against which the commander assesses progress toward accomplishing the mission.⁶

Mulberry A performance objectives were:

1. Establish Gooseberry breakwater at Omaha and Utah beaches.
2. Place interior breakwater of Phoenix caissons at Omaha.
3. Place outer deep water Bombardon breakwater at Omaha.
4. Place the six Lobnitz pier-heads.
5. Construct three floating Whale roadways.
6. Begin operations within 14 days.
7. Output goal of 5,000 tons daily.

The simple modern assessment of operations concludes that force Mulberry achieved the majority of performance objectives ahead of schedule. Granted, two floating roadways were completed before the storm and the 5,000 ton objective was reached only briefly, while operations were conducted. However, on the whole the performance objectives were met.

When the criteria of MOE is brought into the picture the assessment moves from tasks to effect. Mulberry did change the capability and effectiveness of logistics over Omaha beach. In regard to system behavior, Mulberry had a large effect. Discounting the piers and roadways, the breakwaters were highly effective and proved themselves from

the beginning. As a component of Mulberry, the breakwater operation must be given partial credit for the success in drying out LSTs and enabling coasters and ferries safe harbor for offloading. Operationally the caissons and block ships were highly effective. The Lobnitz piers and Whale roadways were not at all effective in enabling Overlord objectives and many critics of the operation focus entirely on their loss. Critics must focus on the results or consequences of Mulberry as whole, and when doing so it is difficult to conclude that Force Mulberry was not effective. An overall assessment using modern practices concludes that operations at Mulberry A were an absolute failure and a complete success. Mulberry operations did not conclude with the destruction of the harbor. Pier and roadway operations were the only components of the harbor that were halted. The Phoenix breakwater was reinforced and additional ships were added to the Gooseberry. Only part of the mechanism that made up operation Mulberry failed, other mechanism, less visible but no less valuable, endured.

The conception, planning, and to a large extent, execution of Mulberry was obviously British. The British began with the concept as early as 1941 and worked the idea through until adoption in 1943. Construction of all the components was a British operation. The equipment and majority of ships used throughout were British. The Phoenix caissons were designed by Tn5 and built by British shipyards. Force Mulberry would never have been able to overcome the shadow of British domination of the project, even with complete success.

Little is mentioned about Mulberry A when operation Overlord is discussed. The men of Force Mulberry have been largely forgotten, eclipsed by other heroics of the Overlord operation. Americans have placed themselves in the role as saviors in World

War II. American industrial might won the war for the Allies. When an operation consists entirely of British ingenuity, British industrial capacity, engineering, and leadership, its place in U.S. World War II history is difficult to mark. The same rationale Commander Stanford had in no officer desiring command of Mulberry, remains true to the historical perspective. Had Mulberry been entirely successful in every facet of the operation, its place in history would remain the same; a small section in the official U.S. histories. Ruppenthal used Stanford's book as a source in writing the official U.S. history in *Logistical Support of the Armies*. Little scholarly work can be found of the U.S. involvement in Mulberry apart from the firsthand accounts written as memoirs by Ellsberg and Stanford.

Part of the issue with the lack of historical significance can be attributed to how secret the concept was. Mulberry was shrouded as a closely guarded secret through October of 1944. Eisenhower expressly forbade release of information about the project. The Mulberry concept was sound and had to remain a secret because there was talk of using a modified design for an artificial harbor in support of the invasion of mainland Japan.⁷ However beyond the issue of secrecy, the lack of information on American involvement cannot be accounted for other than as national bias.

Some criticism of the Mulberry operation is based on the perceived waste of manpower and material. Such criticism is invalid. Commanders must work within the given resources and monetary constraints. Such constraints are a limiting factor in planning and operations. In that concept there is no debate. However, to criticize an operation after the fact will often fall upon a commander's deaf ears. Any attempt to save the lives of soldiers, enhance operations, and mitigate risk will be taken. The monetary

and national resource constraints of the period at the strategic level are of little concern to a person charged with the care and safety of men and women, be it a platoon or multiple armies.

What Force Mulberry completed was monumental. In spite of that, there are no monuments at Omaha beach other than four left over Beetle pontoons washed up on the beach. Few visitors can contemplate what they were. The story of Mulberry A is largely unknown. There are monuments to the overall operation, but these monuments are at Arromanches at the site of the British Mulberry B. Even at the Mulberry museum, there is little mention of the American Mulberry other than the fact that the harbor was destroyed in the June gale.

Overlord operations were successful. The beach assault was successfully supplied over beaches that were sheltered by the Mulberry harbor. LST landings, while delicate were enabled by sheltered water provided by Mulberry A. Stores piers continued to operate over the Phoenix offloaded by DUKW and Rhino ferry. Operationally Mulberry was effective, but was to never be acknowledged by the U.S. The operation was British run, designed, and executed save for the small Mulberry A force. Americans would never give credence to the success of a British operation. Were it not for the Mulberries, the markers and museums commemorating the Allied victory in Normandy might not be there at all.

¹Department of the Army, Field Manual 3-0, *Operations* (Washington, DC: Headquarters Department of the Army, 2008), 7-89.

²Ibid.

³Ibid.

⁴Hans Speidel, *Ideas and Views of Genflm Rommel, Comander of Army Group B, on Defense and Operations in the West in 1944, Fighting the Invasion; The German Army at D-Day*, ed. David C. Isby (London: Lionel Leventhal, 2000), 39.

⁵Field Manual 3-0, *Operations*, 6-25.

⁶Ibid.

⁷Stanford, *Force Mulberry*, 37.

ILLUSTRATIONS



LST At Low Tide on Utah Beach

Source: Walter Bedell Smith, Collection of World War II Documents 1941-1945, Box 48, Amphibious Operations, Northern France Western Task Force, June 1944, Dwight D. Eisenhower Presidential Library

GLOSSARY

Beetle. Reinforced concrete float, or pontoon, to carry the floating roadway.

Bombardon. Floating steel breakwater anchored by Moorings.

Buffer pontoon. Ramp for beaching landing craft at a floating pier-head.

D-Day. Day of Invasion, D+1 is one day after initial assault; D+2 is two days after assault, etc.

Dolphin. Extension to a floating pier-head.

DUKW U.S. manufactured amphibious vehicle: D – year (1942); U – Utility; K – front-wheel-drive; W – two rear driving axles. Also known as “ducks”

E-boat. Fast German motor torpedo boat.

Gooseberry. Sheltered water formed by line of sunken ships.

Measure of Effectiveness. A criterion used to assess changes in system behavior, capability, or operational environment that is tied to measuring the attainment of an end state, achievement of an objective, or creation of an effect. Measures of effectiveness focus on the results or consequences of actions taken. They answer the question, “Is the force doing the right things, or are additional or alternative actions required?” A measure of effectiveness provides a benchmark against which the commander assesses progress toward accomplishing the mission.

Measure of Performance. A criterion used to assess friendly actions that is tied to measuring task accomplishment. Measures of performance answer the question, “Was the task or action performed as the commander intended?” A measure of performance confirms or denies that a unit has performed a task properly.

Mulberry. Artificial harbors for British and American beaches in the Normandy landings.

Neptune. Plan for the amphibious assault phase of Operation Overlord.

Overlord. Codename for the operation designed to take and hold multiple beachheads and enable construction of administrative supply bases in northern France enabling further offensive operations against Germany.

Phoenix. Large concrete caisson fitted with flooding valves to allow sinking, forming the main component of the breakwater at mulberries A and B.

Pluto. —“Pipe under the ocean.” Carried motor vehicle fuel from England to France.

Rhino ferry. Large rafts formed by multiple pontoons propelled by outboard motors capable of carrying large amounts of supplies and vehicles.

Tn5. Transportation 5, organization established under the War Office Transportation Directorate responsible for invasion structures and engineering.

Whale. Codename given to floating roadways used in Mulberry connecting piers with the beach.

APPENDIX A

MULBERRY TIMELINE

- January 1941. ABC-1 agreement established “Germany first” strategy.
1941. Tn5 established under the War Office, Major Bruce White lead.
- December 11, 1941. Germany declared war against the United States.
- January 1942. First Americans land in Great Britain under Bolero.
- April 1942. Marshall Memorandum advocated a cross channel attack (Roundup).
- May 1942. Winston Churchill writes his note about artificial harbors to Combined Operations.
- June 1942. Eisenhower assumed command of ETOUSA.
- August 1942. Torch planning delayed Roundup planning--Eisenhower took command of Allied Forces Headquarters (AFHQ)
- August 19, 1942. The Dieppe Raid.
- Fall-Winter 1942. Roundup remained basis of planning through fall and winter of 1942 in spite of operation Torch being the focus.
- Fall 1942. Tn5 received specifications for artificial harbor pier-head.
- December 1942. Lobnitz pier-head design completed.
- January 1943. Casablanca conference established a combined staff of British and American officers organized under a Supreme Commander and Chief of Staff.
- March 1943. Tn5 began testing of beetles.
- April 1943. British Chiefs of Staff established COSSAC. Overlord planning began.
- April 1943. Design trial for pier-heads and floating roadways began.

May 1943. Trident conference took place.

May, 21, 1943. Chiefs of Staff met endorsing Tn5 plan for artificial harbor.

June 1943. Rattle conference - General Morgan presented the Overlord plan.

July 1943. Outline of Overlord plan approved by British Chiefs of Staff.

August 1943. Quadrant conference in Quebec – Mulberry plan was approved by Combined Chiefs of staff as part of Overlord.

August 24, 1943. Harold Wernher was appointed head of Mulberry project.

August 1943. Lobnitz pier-heads design finalized, twenty-two were ordered.

September 1943. Phoenix caisson design completed.

October 1943. Mulberry harbor design began.

November-December 1943. Sextant conference held in Cairo.

December 1943. Phoenix construction began.

November 1943. Admiral Alan G. Kirk designated Commander Task Force 122.

January 1944. Supreme Headquarters Allied Expeditionary Forces (SHAEF) absorbed COSSAC, Eisenhower commanded.

January 1944. Captain A. Dayton Clark, USN appointed commander Mulberry A.

January 1944. The Combined Staff, at the insistence of the Admiralty, approved the use of blockships (Gooseberries).

February 1944. Neptune plan issued.

Mid February 1944. Personnel trained on Whale installation in Cairnhead Scotland though April 1944

April 1944. Force Mulberry became Task Force 127.1 under 11th Amphibious Force.

June 1, 1944. CTF 127.1 designated CTF 128 and advised D-Day was to be 5 June.

June 4, 1944. CTF 128 advised D-Day delayed until 6 June.

APPENDIX B
CODE NAMES¹

ABC-1. Agreements reached at Washington conference, January – March 1941

ANVIL. The planned 1944 Allied invasion of southern France.

ARCADIA. U.S. British staff conference in Washington, December 1941 to January 1942.

BOLERO. The buildup of troops and supplies in the United Kingdom in preparation for a cross channel attack.

EUREKA. The Tehran conference, 26 November 2 to December 1943.

GYMNAST. 1941 plan for the invasion of North Africa.

JUPITER. The planned invasion of Norway.

MULBERRIES. Artificial harbors for Overlord.

NEPTUNE. 1944 operations within Overlord, specifically the amphibious assault.

OVERLORD. Plan for the invasion of Northwest Europe, Spring 1944.

QUADRANT. The first Québec conference, August 1943.

RATTLE. Conference held by the combined operations headquarters in 1943 to discuss amphibious tactics and techniques. Also known as the Largs conference.

ROUNDHAMMER. Codename used the Washington conference in May 1943 to designate a modified Roundup invasion.

SEXTANT. The Cairo conference, 22 to 26 November 1943.

SLEDGEHAMMER. Plan for limited objective attack across the channel 1942 designed either to take advantage of a crack in German morale or as a sacrifice operation to aid Russians.

TORCH. Allied invasion of northern Northwest Africa, 1942.

TRIDENT. Washington conference, May 1943.

¹Harrison, *The United States Army in WWII, The European Theater of Operations, Cross Channel Attack*, 485.

BIBLIOGRAPHY

Books

- Blumentritt, Gunther, Wilhelm Keitel, Freiherr von Gersdorf, Alfred Jodl, Walter Warlimont, Freiherr von Luttwitz, Max Pemsel, Geyr Leo von Schweppenberg, Hans Speidel, and Gerhard Wagner. *Fighting the Invasion; The German Army at D-Day*, ed. David C. Isby. London: Lionel Leventhal, 2000.
- Churchill, Winston. *Closing the Ring*. Cambridge: Houghton Mifflin Company Boston, 1951.
- . *Triumph and Tragedy*. Cambridge: Houghton Mifflin Company Boston, 1953.
- Ellis, Lionel. *Victory in the West*. London: H.M.S.O., 1962.
- Ellsberg, Edward. *The Far Shore*. New York: Dodd, Mead & Company, 1960.
- Harrison, Gordon A. *The United States Army in WWII, The European Theater of Operations, Cross Channel Attack*. Washington, DC: Office of the Chief of Military History, United States Army, 1951.
- Harrison, Michael. *Mulberry: The Return in Triumph*. London: W.H. Allen, 1965.
- Hartcup, Guy. *Code Name Mulberry*. New York: Hippocrene Books Inc., 1977.
- Kaufman, J. E., and H. W. Kaufman. *Fortress Third Reich*. Cambridge: Da Capo Press, 2003.
- Ohl, John Kennedy. *Supplying the Troops: General Somervell and American Logistics in WWII*. Dekalb: Northern Illinois University Press, 1994.
- Ruppenthal, Roland G. *United States Army in WWII, The European Theater of Operations, Logistical Support of the Armies, Volume I: May 1941-September 1944*. Washington, DC: Center of Military History, United States Army, 1953.
- Stanford, Alfred. *Force Mulberry*. New York: William Morrow and Company, 1951.
- Waddell, Steve Robert. *United States Army Logistics: The Normandy Campaign*. Westport, CT: Greenwood Press, 1994.
- Weigley, Russell F. *Eisenhower's Lieutenants*. Bloomington: Indiana University Press, 1981.

Archival Sources

Dwight D. Eisenhower Presidential Library. Memorandum from Commander Task Force 128 to Commander in Chief, US Fleet, Subject: War Diary of TF 128—forwarding of, August 11, 1944. Dayton Clark Papers, Box 1.

———. Report by Allied Commander-in-Chief Expeditionary Force in Operation Neptune, Volume 1, 1944. Collection of World War II Documents, 1941-45, Walter Bedell Smith, Box 33.

Government Sources

Department of the Navy, Office of Naval Intelligence (ONI) 226, *Allied Landing Craft and Ships*. Annapolis, MD: Navy Institute Press, 1944.

INITIAL DISTRIBUTION LIST

Combined Arms Research Library
U.S. Army Command and General Staff College
250 Gibbon Ave.
Fort Leavenworth, KS 66027-2314

Defense Technical Information Center/OCA
825 John J. Kingman Rd., Suite 944
Fort Belvoir, VA 22060-6218

Dr. Christopher R. Gabel
DMH
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301

Dr. Jon Mikolashek
DMH
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301

Mr. Michael T. Chychota
DTAC
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301