



# D-DAY

NORMANDY 1944



A guide produced and published by  
3D Entertainment Distribution and N3D LAND Films  
Written and Curriculum Developed by Dr. Elisabeth Mantello





## THE FILM

### **70 YEARS AGO, A HISTORIC LANDING CHANGED THE WORLD. A TRIBUTE TO COURAGE, COMPETENCE AND COMMITMENT.**

June 6, 1944: The largest Allied operation of World War II began in Normandy, France. Yet, only a few know in detail exactly why and how, from the end of 1943 through August 1944, this region became the most important location in the world. Blending multiple cinematographic techniques, including animation, CGI and stunning live-action images, "*D-Day: Normandy 1944*" brings this monumental event to the world's largest screens for the first time ever. Audiences of all ages, including new generations, will discover from a new perspective how this landing changed the world. Exploring history, military strategy, science, technology and human values, the film will educate and appeal to all. Narrated by Tom Brokaw, "*D-Day: Normandy 1944*" pays tribute to those who gave their lives for our freedom... A duty of memory, a duty of gratitude.



#### **Director: Pascal Vuong**

*Rewarded very early in his career with a prize for his short-film "The Invisible Man In Blind Love" entirely made with CGI, this former architect went on to work as a director in fields as varied as institutional or corporate films, music videos, TV on-screen identity or publicity for which he made more than 60 commercial films.*

*At the end of 2004, in collaboration with Ronan Chapalain and with the unwavering support of Catherine Vuong, his partner in work and life, he decided to found N3D LAND in order to devote himself fully to three of his passions: film direction, science and technology.*



#### **Narrator: Tom Brokaw**

*A well-respected and trusted figure in US broadcast journalism, Tom Brokaw is best known as the managing editor and unique anchor of NBC News. In this role, he produced and reported documentaries and extended expertise in breaking news events and election coverage. During this time, he was credited for his work in various film and television appearances, radio broadcasts, and several bestselling books, including "The Greatest Generation" and "The Greatest Generation Speaks." Brokaw has also won every major broadcast journalism award, including a Peabody Award, two DuPonts, and several Emmys. He is also recognized for his charity work.*



#### **Historical Advisor: Colonel (US Army Ret.) Peter Herry**

*Peter Herry arrived in the world of film from a background of history and war. As a decorated combat infantryman and West Point professor of history, his knowledge of battlefield dramas led him to advise for movies like "The Lost Battalion," and as president of Blue Line Films, to write and produce documentaries and develop major motion picture projects concerning both World Wars. His presidency of the American Overseas Memorial Day Association, and his long experience strengthening bonds between the American and French armed forces, have left him with a deep respect for the memory of those from both countries who fought together for liberty.*



## A WORD FROM TOM BROKAW

D-Day, the invasion that set the stage for the end of World War II, was the greatest military assault in history, an audacious combination of ground, sea and air forces to gain victory in the greatest war the world had known.

Led by the Americans with British and Canadian forces side by side the invasion faced heavily fortified German positions all along the Norman coastline, the Atlantic Wall.

It was a murderous day as the allies stormed ashore on beaches called Omaha, Utah, Juno, Sword and Gold or dropped from the skies as paratroopers behind enemy lines. Within the French countryside French resistance fighters were invaluable as allies as well.

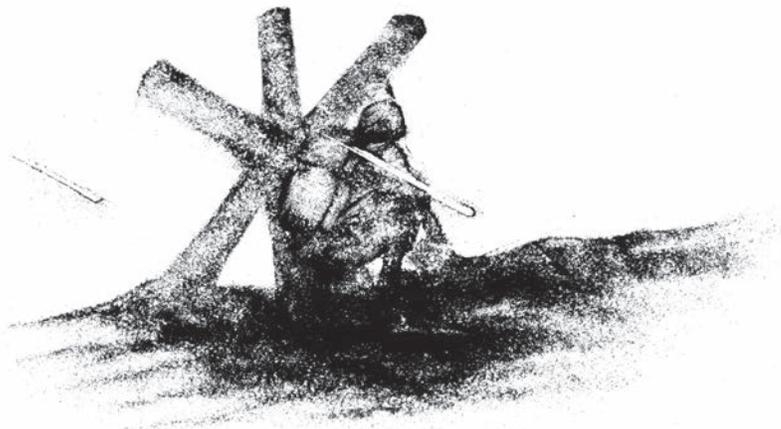
From the sea an Armada of war ships unloaded men and materiel while turning their big guns on German positions.

For a time it appeared the invasion might fail but it did not and the world was saved.

June 6, 1944, will live forever as testimony to military genius, combat bravery of the highest order and the commitment of free people to defeat the ravages of tyranny.

June 6, 1944, a day to ponder and honor forever.

### Tom Brokaw



The Educators' Guide for "*D-Day: Normandy 1944*" serves as an invaluable tool not only for teachers but for everyone, and is a perfect complement to any screening of the film.

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Written by Dr. Elisabeth Mantello  
Consultants: H.Scott Goodrich, Dr. Ernest Roth, Sam Doss  
Editors: Alison Martin, Alexandra Body  
Designed by Malderagraphistes



## INTRODUCTION TO EDUCATORS

*"D-DAY: Normandy 1944"* is a large format documentary produced entirely in 3D that will teach your students about one of the largest military operations ever undertaken. Your students have probably heard of the Second World War as most families today have a relative, a parent, a grandparent or great-grandparent with a connection to this war. However, very few are aware of exactly why and how, from June to August 1944, Normandy became the theater of a battle that forever changed the course of history. Exploring history, military strategy, logistics, science, technology and human values, the film *"D-DAY: Normandy 1944"* guides your students in a step-by-step journey through the events, highlighting who was involved, where, what happened, why, and how. D-Day was the first day of the Battle of Normandy, one of the largest military operations ever undertaken, code-named "Operation Overlord".

The **Educators' Resource Guide** has been designed to enhance your students' experience of the film. Before going to the cinema, your students need to know the historical context of the events they are about to watch. After the film, they should reflect on what they have seen and on some of the consequences of World War II on today's world from a technological point of view.

The **Educators' Resource Guide** is divided into three distinct parts:

The first part *"D-Day – Normandy 1944 - Understanding the historical context"* is intended to serve as a quick reference guide for educators. It gives a brief overview of what led to the Battle of Normandy (code-named Operation Overlord) and D-Day. This part outlines the opposing forces, the Allies' long preparation and logistics, their ingenious deception plan (Operation Fortitude), intelligence work and sabotage actions, the necessary conditions for the landing on D-Day and the role of women during WWII. Operation Overlord succeeded, but it claimed hundreds of thousands of lives, both civilian and military.

The second part *"How WWII influenced technology and sciences"* highlights some of the technological progress that WWII drove in areas like computer sciences, rocket science and aircraft technology. WWII led to significant scientific and technological advancements in other areas that are not developed here such as medicine, surgery, medications, communication systems, navigation, materials, logistical support, industry, and many more.

The third part *"Activities for Students"* presents activities for your students to do before seeing *"D-DAY: Normandy 1944"* and/or after having seen the film.

The material has been developed for students ages 10 to 16. Educators will choose and adapt the activities best suited for their particular class. Activities 2, 3 and 7 can be used for students age 11 and up; activity 1 is more suitable for students age 12 and up; activities 4 and 6 for students age 13 and up; and activities 5 and 8 for students age 14 and up.



# PART I

## UNDERSTANDING THE HISTORICAL CONTEXT



### 1. Operation Overlord: World War II's Largest Amphibious Operation

The Second World War started in 1939, with the German invasion of Poland. One of the deadliest conflicts in human history, WWII claimed over 60 million lives, both civilian and military. Hitler aimed to take over all of Europe for his "Reich" that was to last "1,000 years." Between March 1938 and March 1939 Germany successfully used both political manoeuvring and outright occupation to annex both Austria and Czechoslovakia. In 1940, using "Blitzkrieg (Lightning War)" tactics, Germany successfully invaded Poland, Denmark, Norway, Belgium, the Netherlands, Luxembourg, and France. Only Great Britain resisted Germany's attack, with its air raids that killed thousands of English civilians; Hitler's plan to invade England failed because his Luftwaffe, the German Air Force, was not able to defeat the British Royal Air Force, during what was known as the Battle of Britain. Hitler then changed his plans and turned to the East in June 1941 attacking the Soviet Union, soon on the brink of collapse.

By the end of 1941 Germany, allied with Italy and Japan, controlled virtually all of Europe as well as northern Africa. But the United States entered the war after the infamous Japanese raid on the US naval base in Pearl Harbor, Hawaii, in December 1941. Together with the United Kingdom, the Americans formed a coalition - known as "the Allies" and including Canada, the Soviet Union and over a dozen other countries - to fight against the "Axis Powers," i.e. Germany and its allies.

In the meantime the US and its Allies were building up the necessary troops, ships and equipment to fight a total war. This preparation took several years and required a high level of cooperation between commanders of the Allied forces. To defeat Hitler and free Europe from Nazi tyranny, the Allies decided to execute in the spring of 1944 a strategy they had been planning for several years, i.e. the opening of a second front in Western Europe. Code-named **Operation Overlord**, this elaborate plan was successfully kept secret until it was set into motion on the eve of June 5th, 1944.

During the night of June 5th, 1944, an armada of more than 6,000 ships and landing craft crossed the English Channel. Conveying the Allied ground forces towards the shores of France, the ships dropped anchor around 2 am on June 6th between seven and twelve miles from the coast, most of them out of range of the German artillery batteries. At dawn, landing craft (the "Higgins boats") started to bring these troops and equipment from the ships to the shores of Normandy.

Over 150,000 men landed from the sea onto the beaches on that day during an assault that required over 11,000 aircraft sorties, 3,500 gliders and 20,000 vehicles.

During the same night some 23,000 paratroopers and glider troops landed behind the enemy lines to secure the bridges and roads on the invasion zone for the troops that would arrive later from the beaches. It was the largest use of airborne troops up to that time.



#### Some Allied Leaders

US President Franklin Delano Roosevelt  
British Prime Minister Winston Churchill  
Soviet Union dictator Joseph Stalin  
Free French Forces Leader Charles de Gaulle  
Canadian Prime Minister Mackenzie King  
Australian Prime Minister John Curtin

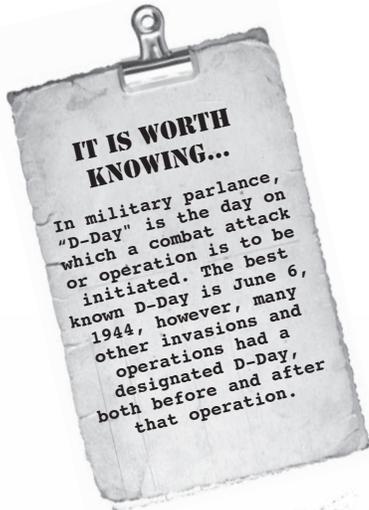


#### The Axis Leaders

German dictator Adolf Hitler  
Italian dictator Benito Mussolini  
Japanese Prime Minister General Hideki Tojo



## D-DAY - NORMANDY 1944



D-Day here refers to June 6th, 1944, the first day of Operation Overlord, and corresponds to the invasion of five Normandy beaches by mostly US, British and Canadian soldiers. The attack combined air, navy and ground forces. D-Day was a turning point for WWII that would end almost a year later on May 8th, 1945. Operation Overlord properly speaking, the Normandy Campaign lasted until the end of August, 1944. Paris was liberated on August 25th, 1944.



The goal of Operation Overlord was to open a second front in the West that would overwhelm the German army already engaged on the Eastern Front. To do so, the Allies had to breach Hitler's "impenetrable" Atlantic Wall.

### THE "ATLANTIKWALL"

The Atlantic Wall was a defensive system put in place by Hitler at the beginning of March 1940 along the 2,500 miles of coastline from Norway down to the Spanish border. Its goal was to protect Hitler's Western front from a seaborne attack. With many artillery batteries and bunkers housing powerful cannons, Hitler wanted the Wall to be an "impenetrable" barrier.

Field Marshal Erwin Rommel, in command of troops defending the coast, reinforced the Atlantic Wall with hundreds of thousands of obstacles and mines, with special attention to the narrowest point between France and Great Britain, the area of the Pas-de-Calais, where the German High Command was expecting the invasion to happen. For Rommel it was crucial to stop the Allies right when and where they landed to prevent them from establishing a foothold that would allow them to bring ashore all the overwhelming resources they were assembling in the United Kingdom.



Rommel's obstacles

# PART I

## UNDERSTANDING THE HISTORICAL CONTEXT



### 2. Preparation

As an invasion plan combining air, sea and ground forces, Operation Overlord represents the largest Allied amphibious military operation in WWII, and relied upon the development of an enormous industrial capacity that took several years to achieve.

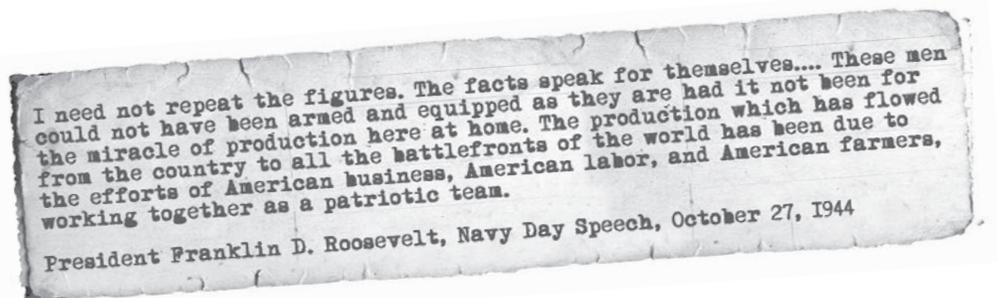
Allied countries dedicated their entire economies and requested the participation of their entire population to support the war effort and develop the military production so crucial to military performance. Every citizen in the US, Canada and the UK was encouraged to participate in the war effort by working, buying war bonds or stamps, saving resources, growing their own food, rationing (food, clothing, gas, leather, etc.) And the great majority of the population did engage in the war effort.



War posters encouraged citizens to support the war effort.

*"Our home fronts have given us an overwhelming superiority in weapons and munitions of war, and placed at our disposal great reserves of trained fighting men." (Eisenhower)*

The United States' war effort was colossal and astonishing. American industry provided almost two-thirds of all the Allied military equipment produced during the war. In four years, its industrial production doubled in size. Maximizing its output resulted in a dramatic increase of its Gross Domestic Product. The war effort in Canada had the same positive results on its own economy. Canada and the US both helped Great Britain whose economy had been overstressed by the conflict with the Nazis, supplying the British with food, raw material, munitions and money.



### 3. Secrecy, Deception and Intelligence

The Allied commanders prepared a surprise attack and managed to keep the date and the place of the landing secret until the last moments.

Breaking the German code system, which used the "Enigma" machine, had given the Allies a head start, often providing a multitude of invaluable information on German intentions. The Germans expected the invasion to take place in the area of the Pas-de-Calais and had thus reinforced their defenses there, as well as placing the bulk of their Panzer divisions east and north of the Seine River to support that defense. The Allies confirmed this belief by using intelligence work and gigantic and ingenious deception plans, with the most famous called **Operation Fortitude**.



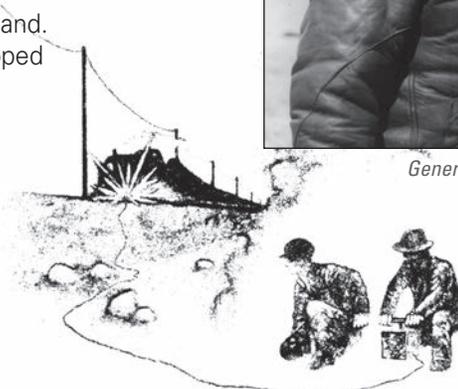
#### A. An Elaborate Deception Plan

Operation Fortitude was an extremely elaborate deception plan that played a crucial diversionary role for the invasion. All sorts of deception and diversion tactics were used including:

- Allied double agents comforted the Germans in their mistaken belief by reporting false information on the First US Army Group (FUSAG) troops amassing just across from Calais and commanded by the famous General George Patton.
- A fake army made of inflatable rubber vehicles, tanks and jeeps, as well as wooden ships and planes, was set up in the southeast of England.
- Tens of thousands of aluminum strips ("window" or "chaff") were dropped on D-Day around Calais and other areas to interfere with German communications and radar, creating the illusion of a large-scale attack.
- Dummy parachutists (made of cloth bags) were dropped south west of Calais and Dieppe, some of which exploded upon contact with the ground.



General George S. Patton



**DID YOU KNOW ?**  
 The coded message "Les sanglots longs des violons de l'automne," the first verse of a very famous French poem by Verlaine, was used to announce to the Resistance that the invasion would soon take place. A few days later the second verse "Blessent mon cœur d'une langueur monotone" was to be the specific call to redouble action against the railway system.

#### B. Intelligence and Sabotage in France

The British secret intelligence services called SOE or Special Operation Executive worked in preparation for the invasion. They supported the local French partisans ("la résistance") as well as the Free French Forces. This government-in-exile force was formed and led by General de Gaulle from London and North Africa. The SOE and the French resistance conducted espionage, sabotage and reconnaissance.

The work in France of the French partisans was essential for the Operation Overlord to succeed. These "résistants" that fought against Nazism in occupied France supplied the Allies with invaluable intelligence information on the German troops and their defense positions on the Atlantic Wall and elsewhere. They weakened German forces in France by performing many thousands of sabotage operations and other actions, including attacking railroads and telephone lines, thus isolating Normandy and cutting communications between the German command posts



Radio Londres broadcast by the BBC was the voice of the Free French Forces sending coded messages to the French partisans in France.

# PART I

## UNDERSTANDING THE HISTORICAL CONTEXT

### 4. D-Day and Normandy

D-Day refers to the first day of the airborne and seaborne invasion on and behind the five beaches located in Normandy, code-named Utah, Omaha, Gold, Juno and Sword. From west to east the invasion area was 50-plus miles wide. Normandy is a region in northwestern France with 350 miles of coastline on the English Channel. The Normandy invasion area is about 90 miles away from the southern coast of England.

#### a. Why land on the beaches of Western Normandy?

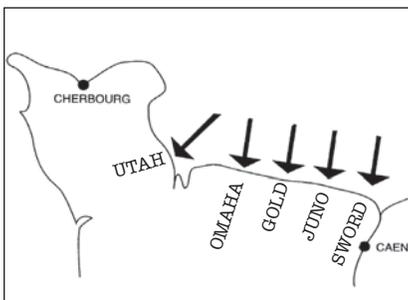
The area of Pas-de-Calais was the ideal location for the landing. Only 21 miles away from the coast of England. It had a deep-water port (Calais) and was the shortest route to Germany. Close enough to England and only 40-150 miles away from the British airfields, it would have allowed excellent Allied air cover for airplanes that had limited autonomy and a shorter range than today.

However, the Allies knew that the Germans were expecting the invasion to land exactly there, and chose instead five landing beaches - code-named Utah, Omaha, Gold, Juno and Sword - in western Normandy some 90 miles away from the coast of England.

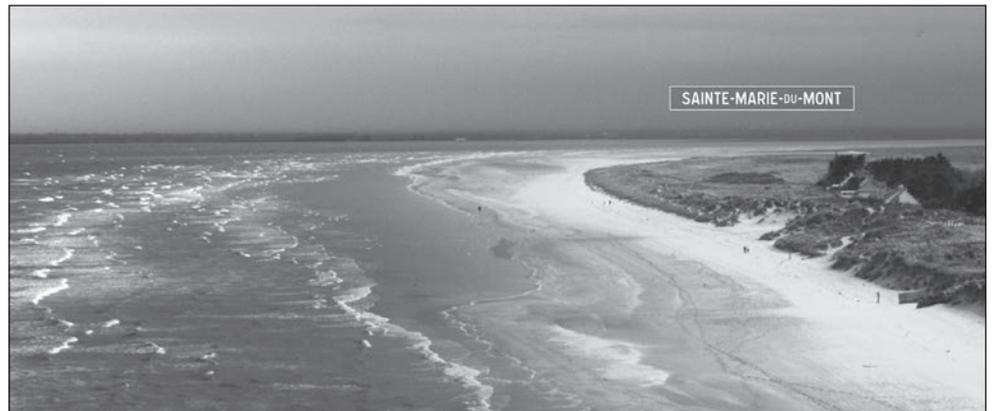
Utah and Omaha beaches were given to the US Army, Gold and Sword to the British, and Juno to the Canadians. The assault sector extended over 50 miles from Sainte-Marie-du-Mont to the estuary of the Orne River.



Normandy



The five beaches in Normandy



- The success of Operation Overlord could only be maintained if more troops landed and were appropriately supplied as they advanced across France after breaking out from Normandy. The Normandy beaches were close to the deep-water port of Cherbourg, objective number one for the American troops. Impossible to capture from the sea, this important port had to be taken from the landward side. Cherbourg was a crucial entry point for tens of thousands of men and millions of tons of supplies and equipment needed for the push to Paris and eventually Berlin. It was essential to have a major harbor large and deep enough to accommodate the biggest ships. Because Cherbourg would take some time to capture, the Allies brought over from England two artificial ports named Mulberry A and Mulberry B. The Allies began setting these up on June 7th respectively at Omaha Beach and Gold Beach. The Mulberry Harbors represent one of the greatest engineering achievements of WWII.



## D-DAY - NORMANDY 1944



- These beaches also gave access to the road network around to Caen, objective number one for the British and Canadian troops, to ensure an anchor for the Allies on the Continent and open up good routes to Paris.
- The Normandy beaches offered good landing terrain as they were flat, wide and deep enough to enable thousands of men and their equipment to land. The countryside was also suitable for the construction of makeshift airfields.

### b. When to land?

The date of the landing depended on a combination of favorable conditions: a full moon, a rising tide at dawn, and of course, reasonably good weather.

**i. A full moon** - For the airplanes bringing the paratroopers that were to be dropped after midnight to secure the flanks of the assault zone, flying at night was crucial so the pilots could avoid the heavy concentrations of German anti-aircraft guns in the invasion area. But a full moon light was helpful for night bombers to find their targets, and especially for the help it provided to nighttime flying for the pilots of the airborne forces. Taking off, assembling, and flying very complex dogleg routes at night was a hazardous business! Also, a full moon would ensure the largest possible tidal range.

**ii. A rising tide at dawn** - The Allied generals decided that to land at night would be too confusing, so a dawn assault would be best. Though a low tide would extend the distance for the landing soldiers as they crossed the beach, a high tide would hide Rommel's deadly obstacles from the landing craft. So a rising tide would be the best for landing as it would allow the combat engineers to destroy German defensive obstacles on the beach and thus help the vessels navigate safely through the cleared and marked channels.



#### Cricket

Originally designed as a time keeping device for band and orchestra leaders, this clicker was used on D-Day by 101st Airborne Division paratroopers as a recognition device.

After landing in the darkness of the night, if a paratrooper came across somebody, he clicked once. If he heard two clicks, he knew it was another paratrooper. If not...

Such conditions do not happen often. They were to be met between June 5th and June 7th. The next possibility would have been ten days later, on June 19th... increasing the danger of this secret plan being discovered.

Planned for several months, D-Day was almost cancelled because of extremely bad weather, and the invasion, originally planned for the 5th of June was delayed by one day. The weather was so terrible that the Germans were convinced that it could not happen that day and Field Marshal Rommel left to celebrate his wife's birthday some 310 miles away.

# PART I

## UNDERSTANDING THE HISTORICAL CONTEXT

### 5. The Conflicting Armies



### THE ALLIES

The following divisions took part in the first assault waves of the operation:

#### Airborne Divisions

- > **US 82nd AIRBORNE DIVISION** (west of Utah Beach)
- > **US 101st AIRBORNE DIVISION** "Screaming Eagles" (west of Utah Beach)
- > **BRITISH 6th AIRBORNE DIVISION** (south and west of Sword Beach, Orne Canal and River)
- > **1st CANADIAN PARACHUTE BATTALION** (Part of 6th Airborne Division)



**US General Dwight D. Eisenhower**  
Supreme Commander of the Allied Expeditionary Forces



**British General Sir Bernard Montgomery**,  
Commander-in-Chief of the British 21st Army Group and pro tem commander of Allied Ground Forces

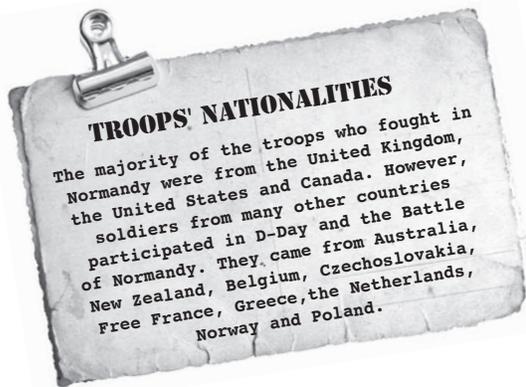
#### > Other Allied Units Attacking on D-Day

##### Infantry Divisions

- > **US 4th INFANTRY DIVISION** (Utah)
- > **US 1st INFANTRY DIVISION** (Omaha)
- > **US 29th INFANTRY DIVISION** (Omaha)
- > **50th BRITISH INFANTRY DIVISION** (Gold)
- > **3rd BRITISH INFANTRY DIVISION** (Sword)
- > **3rd CANADIAN INFANTRY DIVISION** (Juno)

##### Special Forces:

- > **US RANGER FORCE** (2nd Ranger Battalion, at Pointe du Hoc between Utah and Omaha beaches, 5th Ranger Battalion at Omaha Beach)
- > **BRITISH SPECIAL COMMANDOS**
- > **FRENCH 1st BFMC** (Bataillon de Fusiliers marins/ Marine Riflemen Commandos) or "Kieffer Commando" (Sword)



### THE WEHRMACHT

As a result of the relentless pressure on the eastern front and Hitler's orders, most of the German Army's over 300 divisions were stationed in the Soviet Union. The German Supreme Commander (West) Generalfeldmarschall von Rundstedt had roughly fifty-eight divisions under his command on the western front. Thirty-nine of these, averaging 14,000 men each, were placed under Generalfeldmarschall Rommel's orders. Most of these divisions were of moderate to good quality and several consisted of experienced veterans from the Eastern front. Some infantry divisions included troops of lesser quality (young soldiers and older men) considered unfit for the eastern front.

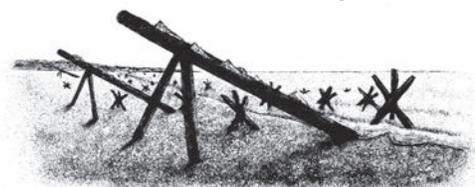
- > **709th INFANTRY DIVISION**, a division including men unfit for the eastern front.
- > **243rd INFANTRY DIVISION**, a division including men unfit for the eastern front.
- > **91st AIR LANDING DIVISION**, an infantry division trained and equipped to be transported by air.
- > **352nd INFANTRY DIVISION**, a well-trained and well-equipped division that included officers and non-commissioned officers that had fought on the eastern front. (The division was rebuilt from a division destroyed on the eastern front.)
- > **716th INFANTRY DIVISION**, a division including men unfit for the eastern front.
- > **21st PANZER DIVISION**, a formidable and well-equipped division with 150 tanks and armored assault guns.
- > **711th INFANTRY DIVISION**
- > **30th MOBILE BRIGADE** with three bicycle battalions.
- > **6th PARACHUTE REGIMENT**, an elite well-led unit composed of young well-trained soldiers.



**German Field Marshal Gerd von Rundstedt**  
Supreme Commander in the West



**German Field Marshal Erwin Rommel**  
Commander of Army Group B, in charge of fortifying and defending the "Atlantic Wall" along the coast of France





## D-DAY - NORMANDY 1944



### Hitler's Convoluted Chain of Command

Hitler exercised complete control over his military because he did not trust most of his commanders. The German chain of command was not running very efficiently. Field Marshal Rundstedt as Supreme Commander West was in command of all of occupied France and other countries in the west. Rommel, who commanded Army Group B (comprising 7th Army, 15th Army, and Armed Forces Netherlands), was Rundstedt's subordinate and as such needed von Rundstedt's permission to move units between his different Armies within the Army Group. But to grant this permission, von Rundstedt needed to send the request to Hitler. To make things more convoluted, Rommel also dealt directly with Hitler.

## 6. Role of Women during World War II

With men gone to the front, the US, Canada and the UK needed women to take jobs to aid the war effort, shifting their role from mainly domestic work to traditionally male jobs. This shift was to trigger important changes in the workplace and society in the decades to come. 400,000 British women, 350,000 US women and 25,000 Canadian women joined the armed forces while women on the home front took over jobs from the men who were away in the Forces, working in factories, garages and farms. They drove buses, taxis, trucks and trains, repaired machinery and operated large engines. Many worked in war plants, as welders, riveters and electricians, helping to provide the necessary material to win the war.

In Great Britain, women code-breakers operated the world's first electronic computer (the Colossus) that deciphered secret German messages. In the United States, young women college graduates were involved with the development of the ENIAC (Electronic Numerical Integrator And Computer), the first general purpose electronic digital computer. Some did trajectory computations while others worked as programmers. Almost all programmers during WWII were actually women, and they made significant contributions during the beginnings of computer sciences and its later development. Women also served as spies in the British SOE, or Special Operations Executive and in the American OSS, or Office of Strategic Services, the ancestor of the CIA.

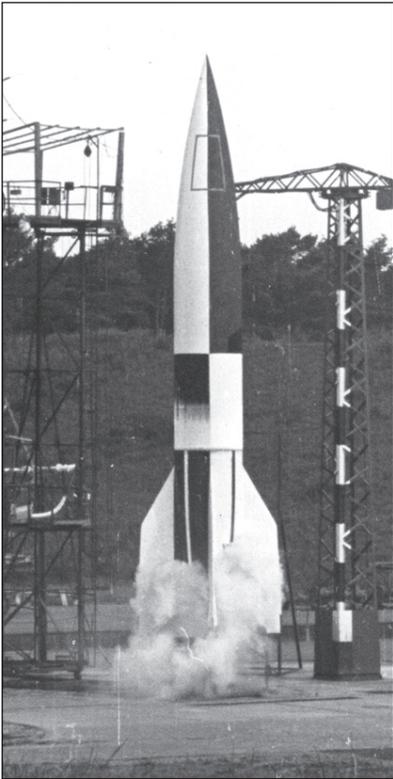


In occupied France, women also played a crucial role as part of the French Resistance, a group of active opponents of the Nazi occupation of France. They served as liaison agents, couriers and "letter boxes," and collected information, produced and distributed underground newspapers, ran underground presses, made illegal identity cards and assisted fugitives in escaping across the border. They also participated in armed combat, sabotage and other actions, all of this at the peril of their own lives. Many were arrested, deported, tortured and/or killed.



# PART II

## HOW WWII INFLUENCED TODAY'S TECHNOLOGY



V2

### GPS

*Satellites have enabled us to investigate our world, to forecast the weather, and to communicate instantaneously around the globe. The Global Positioning System (GPS), a space-based satellite navigation system, provides location (longitude and latitude) and time information in all weather conditions, anywhere on or near the Earth. It gets the information from a network of orbiting satellites and ground stations. Thanks to personal GPS devices, people can get world-wide navigation information. And you can fly virtually everywhere on Earth thanks to Google Earth...*

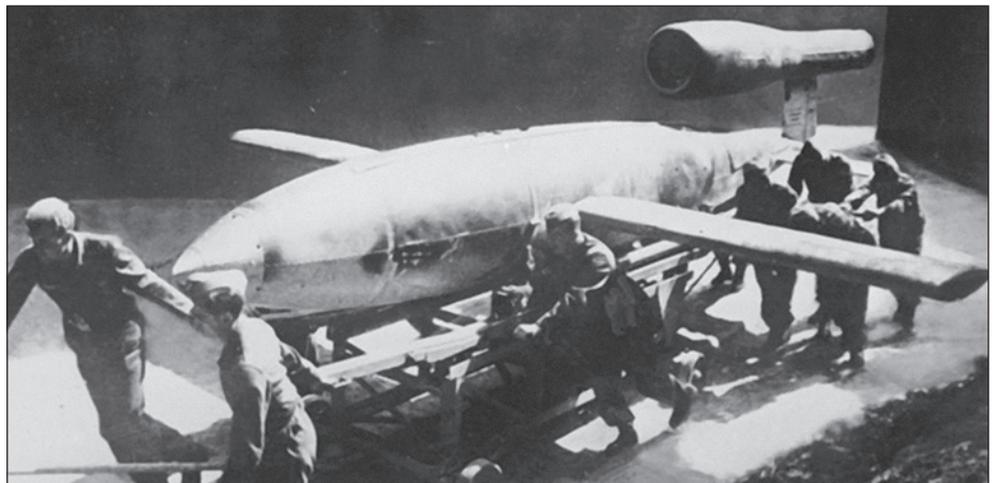
Technology played a crucial role in WWII as the Allies and Axis powers were trying to get the upper hand in the arms race. Conflicting nations' needs of war drove technological development to incredible levels as they competed to improve their weapons, vehicles, aircraft, ships, equipment, communication systems, navigation, nutrition, materials, medications and more. These numerous innovations and inventions of World War II have since become widely deployed in the civilian world and have a profound effect on our lives today. A few of them are presented below.

### 1. From the V2 to the Conquest of Space

German engineers in the 1940s had developed new deadly weapons: The V1 and the V2 – V for "Vergeltungswaffe" or revenge weapon. The V1 was the first cruise missile, a flying bomb that carried 1,900 lbs of high explosives, travelled at a maximum speed of 400 mph and had a range of 150 miles. The Germans launched about 9,000 V1's at southern Britain, primarily London, starting on June 13th, 1944, just one week after the successful Allied landings in Normandy. But their impact was limited as over 50% of the V1's fired were intercepted and destroyed before they reached their goal. However, they caused the death of about ten thousand people.

Far more dangerous were the V2's, the world's first rocket missiles, which carried one ton of high explosives, had a range of over 186 miles and travelled at a speed of over 3,100 mph. At this speed, nothing could stop them. However, they were not very precise when they were launched at London late in the summer of 1944. While they still killed many civilians and some Allied troops, V2's strategic impact remained limited as they came too late in the war to change its outcome. According to General Eisenhower, the V2's could have made Operation Overlord impossible to stage had they been developed earlier and used against Allied embarkation ports in England.

The German V2 rocket is the mother of all modern rockets, including those used by the US and Soviet Union's space programs.



V1



## D-DAY - NORMANDY 1944

Rocket development during WWII is associated with Nazi Germany and German scientists such as Wernher von Braun whose work spear-headed missile developments after the war both in weapons and in space exploration. Both the US and the Soviet Union began a variety of experimental programs. In the late 1950s both countries were able to launch earth-orbiting artificial satellites (Sputnik, Explorer). Soon people were launched into space. Soviet Yuri Gagarin in 1961 became the first person to orbit Earth, traveling in the capsule-like spacecraft Vostok 1. The development of this technology eventually led to the US space program that would to send a man on the moon. On July 20th, 1969, U.S. astronauts Neil Armstrong and Buzz Aldrin became the first men to walk on the moon's surface. Rockets have opened up space to exploration and commercial exploitation.

## 2. From the First Jet Fighter Plane to Today's Global Commercial Air Transportation

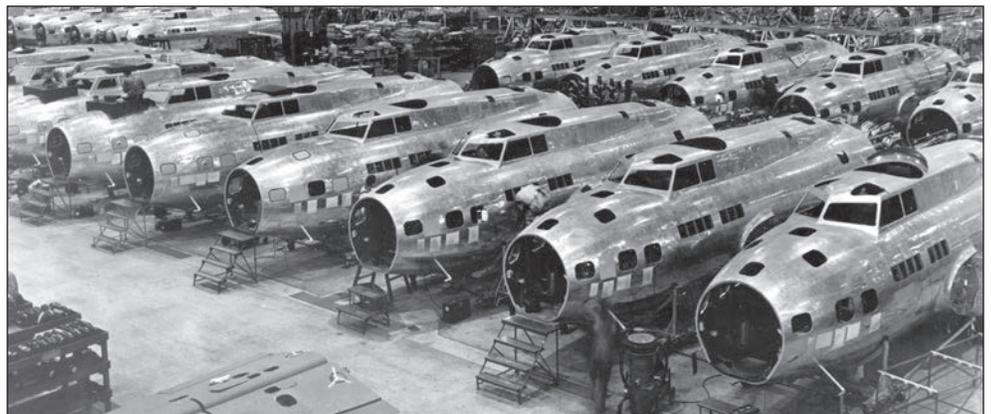
During the course of the fighting, the Allies and Axis developed increasingly more advanced aircraft. The Germans built the world's first jet fighter, the Messerschmitt Me 262 Schwalbe. This first and only jet fighter plane to fly in combat during WWII was able to surpass the fastest Allied fighter. However, it consumed a lot of fuel and only 1,400 were built. The Allied air forces were superior in numbers, thus the Me 262 had limited effect.



Messerschmitt Me 262

The British and the Americans were simultaneously working on a jet fighter plane. With this technology General Electric (GE) built jet engines for America's first jet fighter, the Bell XP-59, but it was not used in combat. After WWII, the jet-powered engine was used for all fighter planes. The Russians would later use this technology to develop the MiG-15 jet fighter that fought U.S. F-86 Sabre jet fighters and bombers during the Korean War.

In the early 1950s, further development of this technology was applied to commercial flying. The DH 106 Comet was the first production commercial jetliner (UK) while the Boeing 707 jetliner (US) and the Douglas DC-8 were the first commercially successful jetliners. This technical advancement led us to worldwide, affordable, commercial air transportation with tens of thousands of flights per day.



# PART II

## HOW WWII INFLUENCED TODAY'S TECHNOLOGY



German coding machine "Enigma"

ATWCI TUFCD YIMLK  
FTG6P GTYUI RFDSX  
HIPPS OGULI YTUUI  
DIOPA LLIHC TUIPM  
JKLIM HYTNJ GYIOR  
DLMB7 SDERW USCYJ

### COMPUTING SPEED BEFORE ENIAC...

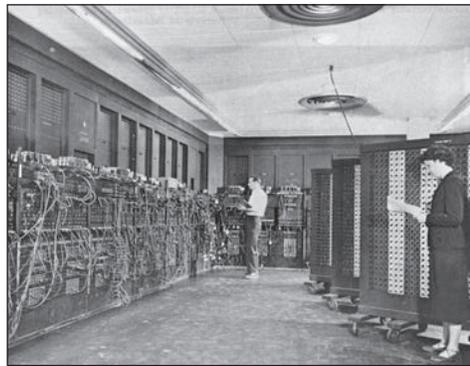
*ENIAC could add 5,000 numbers or do 357 10-digit multiplications in one second. At the Ballistic Research Lab, Aberdeen Proving Ground, it took 3 days for 100 graduate students to calculate a single trajectory for a weapon. The ENIAC could do the same in just 30 seconds, being 1,000 times faster than a person with a calculator.*

### 3. The Road to our Computer Age

By deciphering the coded messages sent by the Germans, the Allies gathered vital intelligence that allowed them to foil German plans. This deciphering opened the road to the Computer Age.

Leading a team of code breakers, the British mathematician Alan Turing and another Cambridge mathematician, Gordon Welchman, developed an electromechanical machine known as a "Bombe" that successfully decoded the German coding machine "Enigma". Enigma looks like a typewriter but it is a complicated machine that types messages in code, then scrambles it by using three to five rotors (notched wheels), each of which displays an alphabet. The person receiving the message needed a key to the code, i.e. the settings of these rotors, to understand the message. It allowed an incredible number of possible combinations and was supposed to be unbreakable.

The British code breakers and the engineer Thomas Flowers, contributed to the design of the first programmable electronic digital computer, known as Colossus, to help solve encrypted German messages coded by machines much more complex than the Enigma. The Colossus Mark 2 with a much higher speed was developed just in time for D-Day. However, these code-breaking computers were not general purpose. Two US computer pioneers, John Mauchly and J. Presper Eckert, conceived and designed the first fully programmable digital electronic computer, known as ENIAC (Electronic Numerical Integrator and Computer). It was also the first electronic general-purpose computer.



ENIAC



Smart Phone

ENIAC was initially designed to calculate artillery firing tables for the US Army, the very tables that would allow soldiers to figure out at what angle to aim their cannon. It answered the Army's need for faster and more precise firing capabilities. ENIAC's calculation speed was 1,000 times that of existing devices.

These high-speed calculations, coupled with general-purpose programmability, solved problems that were previously unsolvable. In addition to ballistics, the ENIAC also worked on weather prediction, random-number studies, and wind-tunnel design. ENIAC weighed about 30 tons, occupied about 1,800 square feet and was able to do simple equations. It cost close to \$500,000.00 to produce. It was able to process at 0.1 MHz. Today a 3.95-ounce iPhone 5 can run at 800 MHz, which is 8,000 times faster and more powerful!



## D-DAY - NORMANDY 1944

In the 1950s and 1960s, most computers were large machines that could only be run by trained specialists and they were very expensive. But the computers progressively became much smaller, faster and cheaper. By the 1980s, the personal computer was born thanks to small and cheap integrated circuits and microprocessors. Further developments in computer science led to all those new applications that we are using today in our everyday life from smart phones to the GPS, Internet and many more. Computers have invaded all areas of our lives.



Radar

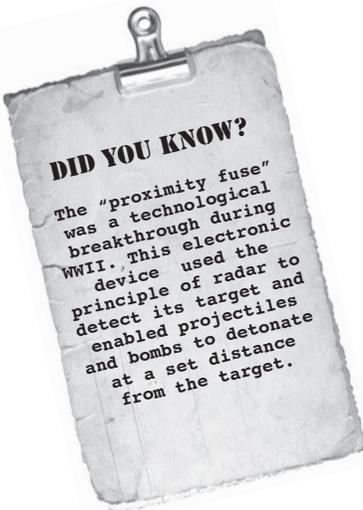
### 4. The Road Opened by Radar Technology

Developed just before WWII in many countries (Europe, the US, Soviet Union), radar played a huge role during the war as both the Allies and the Axis were using and further developing this technology. Radar, or Radio Detecting And Ranging, works by sending out radio waves and detecting any reflections from distant objects.

Radar found dozens of applications during the war. It was put on ships to navigate at night and through fog, to locate enemy ships and aircraft and to direct gunfire. It was put into airplanes to locate enemy aircraft or ships, to direct gunfire, and to find bombing targets. Military meteorologists used it to detect storms, a detection crucial to operations such as the Invasion of Normandy.

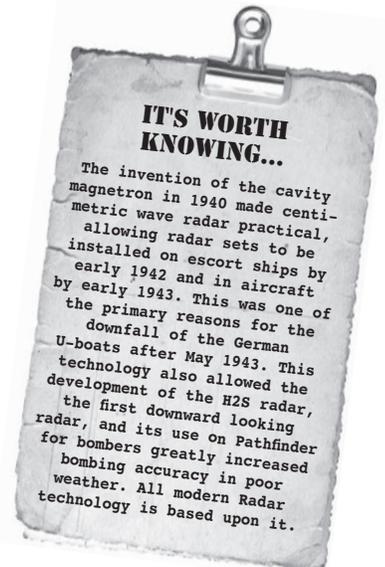
#### Modern radar is now used in thousands of applications from military to civilian.

- Civil aviation, maritime traffic and meteorology have benefited from Radar technology.
- Radar detects speeding offenders on civil roads.
- Radar display systems are the direct precursors of 2-dimensional sonars and medical ultrasonic systems that appeared in the late 1940s.
- Microwave ovens.



#### DID YOU KNOW?

The "proximity fuse" was a technological breakthrough during WWII. This electronic device used the principle of radar to detect its target and enabled projectiles and bombs to detonate at a set distance from the target.



#### IT'S WORTH KNOWING...

The invention of the cavity magnetron in 1940 made centimetric wave radar practical, allowing radar sets to be installed on escort ships by early 1942 and in aircraft by early 1943. This was one of the primary reasons for the downfall of the German U-boats after May 1943. This technology also allowed the development of the H2S radar, the first downward looking radar, and its use on Pathfinder for bombers greatly increased bombing accuracy in poor weather. All modern Radar technology is based upon it.

#### A word about SONAR

*Sonar Sound Detecting And Ranging functions like radar, using sound instead of radiation to detect objects. Ultrasound scanners can be seen as a form of "medical" sonar.*

*An ultrasound scan is a device that uses high frequency sound waves to create an image of some part of the inside of the body, such as the stomach, liver, heart, etc.*

*Obstetric sonography is frequently used to check the baby in the womb.*

**Huge advances were made in medicine and surgery** in the 1940s as a direct response to war. Penicillin, discovered in the 30s, was further developed in the 40s to become a more potent antibiotic. It was mass produced and made available to civilians. It has since become the most widely used antibiotic to date. Safe and widely available blood transfusions proved to be the most important medical advancement credited with saving the lives of soldiers. Since, there have been many advances and technical developments and blood transfusion is a lifesaving treatment that is among the most common medical procedures.



# ACTIVITY 1.

## Reading a Map – Troop Movements on D-Day (7th Grade and up/Age 12 and over)

### a. Preliminary Research

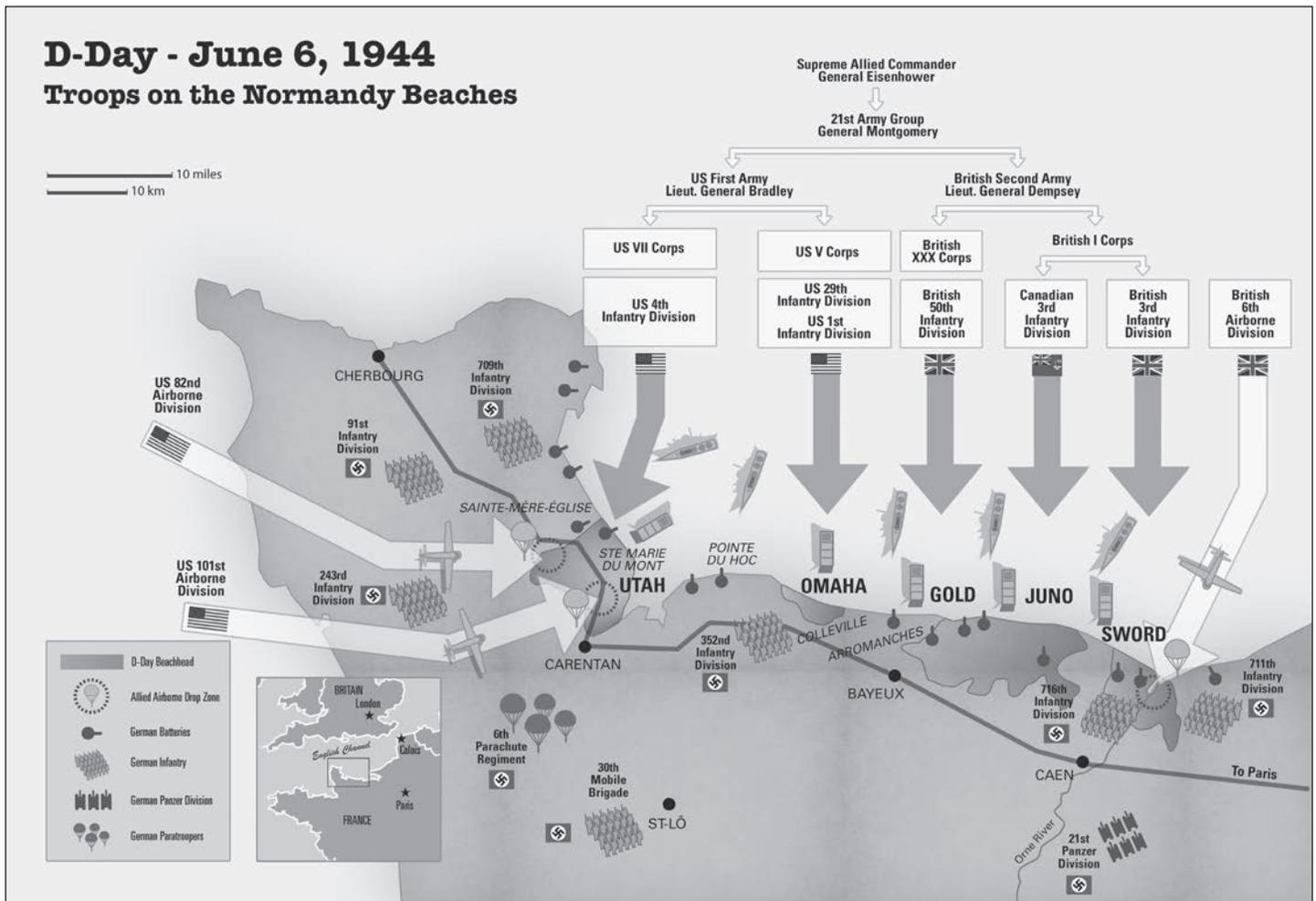
Use books and/or the Internet to answer the following questions:

1. Where is Normandy located?

2. Where is Normandy in relationship to London? And in relationship to Paris?

3. Where are the French cities of Calais and Cherbourg located in relationship to the coast of England?

4. To get from Normandy to Germany, which direction do you travel?





**b. Reading a Map - Analyze the map on the left page and answer the following questions:**

1. Where were the Allied parachutists dropped?

.....  
.....

2. How many US divisions took part in the landing? Name them

.....  
.....

3. How many British divisions took part in the landing? Name them.

.....  
.....

4. What is the nationality of the troops that landed on Juno Beach?

.....  
.....

5. Using the map scale, determine the length of the invasion area.

.....  
.....

6. How many German divisions can you locate? Name some of them.

.....  
.....

7. How different is the German 21st Division?

.....  
.....

8. Which geographical obstacle prevented the German 21st Division from attacking the Allies on D-Day?

.....  
.....

9. What are the five biggest cities in the area? Name them.

.....  
.....

10. Why do you think the city of Cherbourg was strategic for the Allies?

.....  
.....



## ACTIVITY 2.

### What are they for? (6th Grade and up/ Age 11 and over)

In the film you see a lot of the material, equipment and vehicles used during Operation Overlord. What were they used for? Match each name with the correct description, before you see the film and after you have seen it.

BEFORE THE FILM		AFTER THE FILM
	1. C-47	
	2. V2	
	3. Radar	
	4. Mulberry	
	5. Cricket	
	6. Glider	
	7. Higgins Boat	
	8. Enigma	
	9. Me 262 Messerschmitt	
	10. Window	

- a. Clouds of metallic strips dropped from airplanes to interfere with radar and communications.
- b. A light aircraft that flies without using an engine.
- c. German code machine used to send secret messages.
- d. First jet fighter.
- e. Used for the amphibious landing of troops on the 5 Normandy beaches.
- f. Makeshift harbors on Normandy beaches.
- g. Used to detect movements of objects.
- h. First rocket missile.
- i. Military transport aircraft extensively used by the Allies.
- j. Device to help paratroopers locate each other on land.

## ACTIVITY 3.

### D-Day Combatants Numbers (6th Grade and up/ Age 11 and over)

Calculate the percentage of each country's military forces in Normandy on D-Day using the numbers below.

Country	Number of soldiers	Beaches	Percentage
United Kingdom	62,000	Sword, Gold	
Canada	21,000	Juno	
United States	73,000	Utah, Omaha	
Germany	105,000	All	
<b>Total</b>	<b>261,000</b>		<b>100%</b>

Answer the following questions:

1. What country had the most troops in Normandy on D-Day?: .....
2. What percentage of the troops were Allied troops? .....
3. Why do you think the Allied troops succeeded? .....



# ACTIVITY 4.

## All about Numbers - Multiple Choice Exercise

(8th Grade and up/ Age 13 and over)

Look at these questions before you see the film. See if you can answer them after you have seen the film, check your answers on the Internet or in books and correct them when necessary.

- 
1. What is the distance from the French city of Calais to the Coast of England?  21 miles  
 210 miles  
 2,100 miles
- .....
2. What is the total length of the landing area (5 beaches)?  50 miles  
 500 miles  
 5,000 miles
- .....
3. The C-47 Skytrain is the most produced military transport aircraft in history. How many were built?  100  
 10,000  
 100,000
- .....
4. How many men could fit in one Higgins landing boat?  10  
 36  
 160
- .....
5. Hitler gave orders not to wake him up before a certain time on the 6th of June 1944. What time was it?  3 am  
 9 am  
 11 am
- 

# ACTIVITY 5.

## Radar Detection: How far is the target?

(9th Grade and up/ Age 14 and over)

A pulse radar sends out radio waves in short bursts or pulses. The distance to a target is determined by the time it takes the signal to reach the target and the echo to return.

Radar signals travel at the speed of light: about 186,000 miles per second.

Question: If a signal is transmitted by a radar antenna at time equals zero, and comes back in 1/1,000 second later, how many miles away is the target detected by the radar?

ANSWER: Please explain your answer: .....

.....

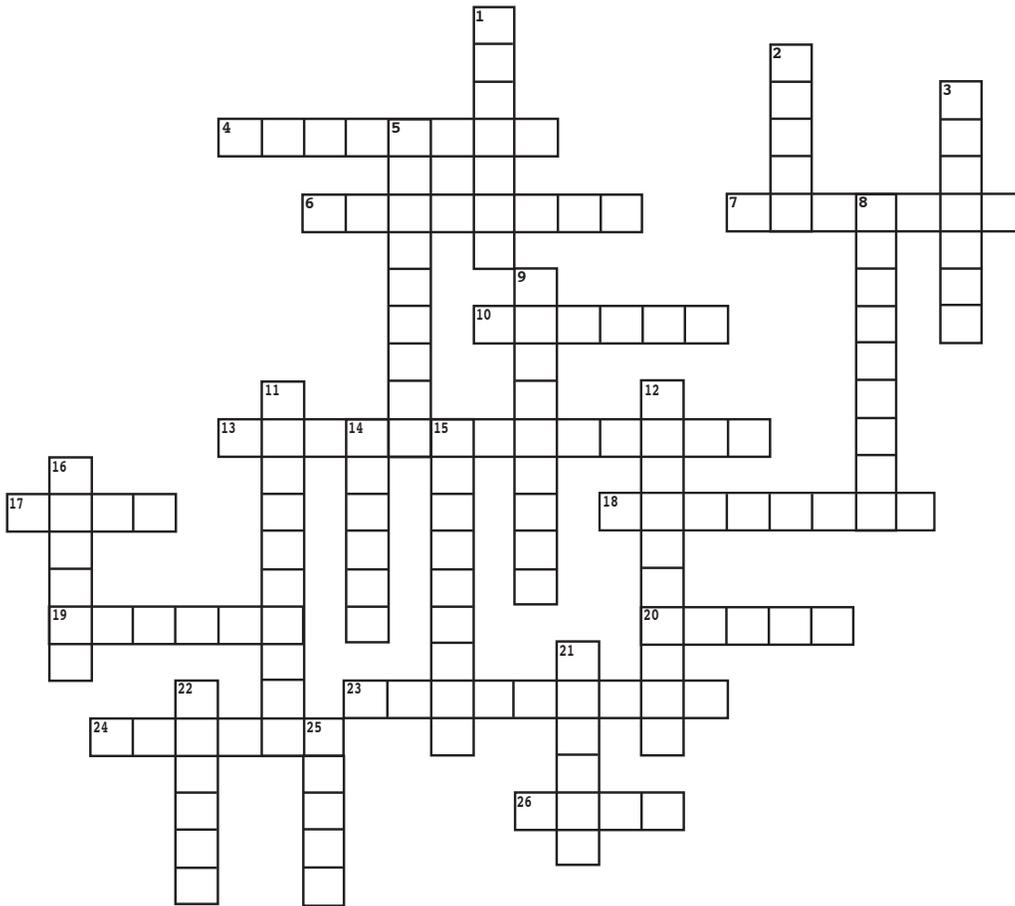
.....

.....



## ACTIVITY 6.

### WWII General Knowledge - Crossword (8th Grade and up/ Age 13 and over)



**SHERMAN GLIDER NORMANDY FORTITUDE BULLDOZER LIBERTY CRICKET ENIGMA RESISTANCE  
ROOSEVELT CHURCHILL HITLER JUNO MESSERSCHMITT OMAHA DE GAULLE SPITFIRE ROMMEL  
PARACHUTE RADAR STALIN BUNKER JEEP CALAIS TIGER EISENHOWER**

**Across**

- 4. British fighter aircraft used by the Royal Air Force.
- 6. Region in northwestern France with a coastline on the English Channel.
- 7. Little object used by paratroopers to locate each other after landing in Normandy.
- 10. Major ferry port in Northern France where Germans expected the Allied invasion.
- 13. German company that built the first jet fighter plane called Me 262.
- 17. Code name of the beach where the Canadian troops landed on D-Day.
- 18. French general who led the Free French Forces (Resistance) from London.
- 19. German code machine deciphered by the British code-breakers.
- 20. Code name for one of the US sectors of the Allied landings in Normandy.
- 23. Powerful tractor with a broad blade at the front for clearing ground.
- 24. Light aircraft that flies without using an engine.
- 26. Light, sturdy 4-wheel-drive vehicle of the US Army.

**Down**

- 1. Battle tank used by the US and the other Western Allies in WWII.
- 2. Powerful German tank used in WWII.
- 3. Name given to the cargo ships that transported men and equipment during WWII.
- 5. Code name for the Allied deception operation preceding the Normandy landings.
- 8. British Prime Minister that led Britain throughout WWII.
- 9. A cloth canopy that allows a person attached to it to descend slowly when dropped from an aircraft.
- 11. Armed French partisans that fought against German Nazi occupation of France and facilitated the Allies' rapid advance through France following D-Day.
- 12. US General and Supreme Commander of the Allied Expeditionary Forces in Western Europe during WWII.
- 14. Communist dictator of the Soviet Union allied with Roosevelt and Churchill to defeat the Nazis.
- 15. 32nd President of the US (1933-45).
- 16. A partially underground shelter of reinforced concrete built as part of a fortification.
- 21. German Field Marshal; known as the Desert Fox.
- 22. Dictator of Nazi Germany whose expansionist foreign policy precipitated WWII, while his fanatical anti-Semitism led to the Holocaust.
- 25. Detection system that uses radio waves to determine the range, altitude, direction or speed of objects, aircraft, ships.



# ACTIVITY 7.

## Learning Secret Code Writing and Decoding

(6th Grade and up/Age 11 and over)

Writing and breaking secret messages played a huge role during WWII. Writing secret messages has existed for thousands of years. Learn a few basic ways how to write secret messages, and decode them.

### a. Writing a code by reordering the letters of the message.

Look at the following example:

The plain text, i.e. the message you want to send, is "meeting tomorrow at dawn".

The protocol to code this message consists in using every other letter and write them as follows:

M	E	I	G	O	O	R	W	T	A	N
E	T	N	T	M	R	O	A	D	W	

The coded message reads **MEIGOORWTANETNTMROADW.**

M	E	E	T	I	N	G	T	O	M	O	R	R	O	W	A	T	D	O	W	N
M	↓	E	↓	I	↓	G	↓	O	↓	O	↓	R	↓	W	↓	T	↓	O	↓	N
	E		T		N		T		M		R		O		A		D		W	
M	E	I	G	O	O	R	W	T	A	N	E	T	N	T	M	R	O	A	D	W

Exercise: Using this method, choose a different protocol and write a message.

Plain text:.....

Protocol:.....

Coded message:.....

### b. Writing a code by replacing each letter of the text by another letter of the alphabet, or a number or a symbol.

Look at the following example. Each letter of the message is shifted forward 3 places in the alphabet.

Plain text: "Launch attack at dawn"

Protocol: Each letter of the message is shifted forward 3 places in the alphabet.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	

Coded Message: **I X R K Z E X Q Q X Z H X Q A X T K**

L	A	U	N	C	H	A	T	T	A	C	K	A	T	D	A	W	N
I	X	R	K	Z	E	X	Q	Q	X	Z	H	X	Q	A	X	T	K

Exercise: Following this method, use a different shift (from 4 to 26), and create your own message.

Message to send:.....

Protocol:.....

Coded message:.....



## ACTIVITY 8. A Bit of Logistics

(9th Grade and up/Ages 14 and over)

How do you supply an army with food, equipment, medical supplies, ammunition and the rest of what would be needed?

D-Day was a complex and enormous undertaking assembling hundreds of thousands of soldiers, thousands of boats and planes alongside millions of tons of equipment and supplies. Logistics played a crucial role in the success of this mission.

Let's get an idea of the magnitude of the things that were needed... by calculating the following:

### 1. Feeding the Troops

**1a.** One soldier needs an average of  $2\frac{3}{4}$  pounds of food a day. 73,000 US soldiers landed by boat on the beaches of Normandy on D-Day.

**How many tons of food per day were needed to feed them?**

**1b.** The famous "2  $\frac{1}{2}$  ton truck" was used to bring food for these 73,000 US soldiers to the depot.

**How many of these trucks should be loaded per day just to carry food?**

### 2. Ammunitions

**2a.** Assuming that US soldiers during WWII needed 30 lbs. of ammunition per day for their M-1 Garand semi-automatic rifle, **how many tons of ammunition were to be provided for per day for the 73,000 US troops?**

**2b.** The "2  $\frac{1}{2}$  ton trucks" were bringing these ammunitions to the depot.

**How many truckloads a day were required per day to bring the ammunition to 73,000 US soldiers?**





# ANSWERS TO THE ACTIVITIES

## ACTIVITY 1

a.

1. Normandy is a region in northwestern France with 350 miles of coastline on the English Channel. The Normandy invasion area is about 90 miles away from the southern coast of England.

2. Normandy lies south-south west from London and west from Paris.

3. Situated 21 miles only south east of England, Calais and its port are the closest French point to the coast of England, and the shortest route to Germany. The French city of Cherbourg is situated at the end of the Cotentin Peninsula, 81 miles south from Portsmouth on the coast of England.

4. To get from Normandy to Germany, you travel east.

b.

1. Sainte-Mère-Eglise; Utah Beach near Sainte Marie du Mont; Sword Beach in the area of the bridge on the Orne river, code-named Pegasus bridge.

2. Five divisions: 1st Infantry, 4th Infantry, 29th Infantry, 82nd Airborne, 101st Airborne

3. Three divisions. 50th Infantry, 3rd Infantry, 6th Airborne.

4. Canadian (Canadian 3rd Infantry).

5. About 50 miles.

6. You can read on this map the names of 7 German divisions: 709th Infantry Division; 91st Air Landing Division; 243rd Infantry Division; 352nd Infantry Division; 21st Panzer Division; 716th Infantry Division and the 711th Infantry Division. There were other troops such as the 30th Mobile Brigade and the 6th Parachute regiment.

7. The German 21st Division was a well-trained and well-equipped division with 150 tanks and armored assault guns.

8. The obstacle was the Orne river.

9. Cherbourg, Carentan, Bayeux, Caen, St-Lô.

10. The largest and most accessible deep-water port from the landing area, Cherbourg was a crucial entry point for tens of thousands of men and millions of tons of supplies and equipment needed for the push to Paris and eventually to Berlin.

## ACTIVITY 2

1=i 2=h 3=g 4=f 5=j 6=b 7=e 8=c 9=d 10=a

## ACTIVITY 3

United Kingdom: 24%; Canada: 8%; USA: 28%; Germany: 40%

1: Germany

2:  $24+8+28 = 60\%$

3: Among other factors: secret plan and surprise assault at dawn despite terrible weather on Normandy beaches instead of Calais, great Allied commandment, Allied air force superiority, huge number of Allied troops and enough supplies, equipment and materiel, poor German commandment from Hitler, most German divisions on the Eastern Front, lack of German supplies and equipment.

## ACTIVITY 4

1: 21 miles

2: 50 miles

3: 10,000- The C-47 Skytrain is the most produced airplane in history with over 10,000 made.

4: 36

5: 9 am.

## ACTIVITY 5

186,000 miles/second :  $1/1000 = 186$  miles.

Roundtrip =>  $186 : 2 = 93$  miles.

The target is 93 miles away.

## ACTIVITY 8

1a.  $2.75 \times 73,000 = 200,750$  lbs=>100.375 tons of food per day.

1b.  $100.375$  tons :  $2.5 = 40.15$  => 41 truckloads per day of food.

2a.  $30$  lbs x  $73,000 = 2,190,000$  lbs => 1,095 tons of ammunition per day.

2b.  $1,095$  tons :  $2.5 = 438$  truckloads of ammunition per day.

3a. ( $10$  nautical miles x  $2$ ) :  $5$  knots =  $4$  hours round trip, plus  $3$  minutes to unload and another  $3$  minutes to reload with men. Total=  $4h06$  min.

3b.  $800 \times 32 = 25,600$  :  $132,000 : 25,600 = 5.15$  i.e.  $6$  roundtrips per boat.

3c. With a  $20\%$  loss, you should start with  $1000$  boats.

4a.  $(80 + 80) : 4 = 40$  gallons to go roundtrip in a  $2 \frac{1}{2}$  ton truck.

4b.  $3,000 : 2.5 = 1,200$  roundtrips and  $1,200 \times 40 = 48,000$  gallons of gas needed.



SUPREME HEADQUARTERS  
ALLIED EXPEDITIONARY FORCE



Soldiers, Sailors and Airmen of the Allied Expeditionary Force!

You are about to embark upon the Great Crusade, toward which we have striven these many months. The eyes of the world are upon you. The hopes and prayers of liberty-loving people everywhere march with you. In company with our brave Allies and brothers-in-arms on other Fronts, you will bring about the destruction of the German war machine, the elimination of Nazi tyranny over the oppressed peoples of Europe, and security for ourselves in a free world.

Your task will not be an easy one. Your enemy is well trained, well equipped and battle-hardened. He will fight savagely.

But this is the year 1944! Much has happened since the Nazi triumphs of 1940-41. The United Nations have inflicted upon the Germans great defeats, in open battle, man-to-man. Our air offensive has seriously reduced their strength in the air and their capacity to wage war on the ground. Our Home Fronts have given us an overwhelming superiority in weapons and munitions of war, and placed at our disposal great reserves of trained fighting men. The tide has turned! The free men of the world are marching together to Victory!

I have full confidence in your courage, devotion to duty and skill in battle. We will accept nothing less than full Victory!

Good Luck! And let us all beseech the blessing of Almighty God upon this great and noble undertaking.

*Dwight D. Eisenhower*

*General Eisenhower's Message to the Troops of the Allied Expeditionary Force  
on June 6, 1944.*

# D-DAY

NORMANDY 1944



If you look at a map of Normandy, you will see that beaches still have their invasion code-names: Utah, Omaha, Gold, Juno, Sword. Streets nearby are even named after the troop units that fought there. As well as the beaches and other landmarks, such as the Pegasus bridge, the Pointe du Hoc and the Mont-Ormel you can visit war museums, memorials and cemeteries in Normandy. They commemorate all those who were part of D-Day and the Battle of Normandy. The cemeteries, honoring the troops who died, include: The American Cemetery in Colleville-sur-Mer, the British Cemetery in Ranville, the Bayeux War Cemetery, the Canadian War cemeteries in Réviers and Cintheaux and La Cambe, the German War Cemetery.

A film by Pascal Vuong  
Produced by N3D LAND Films  
Released by 3D Entertainment Distribution

[www.DDAY-NORMANDY1944.com](http://www.DDAY-NORMANDY1944.com)

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