



# D-DAY: Whether the Weather Matters

# D-DAY: Whether the Weather Matters



## INTRODUCTION

Extreme planning was required to coordinate the 5,000 ships, 11,000 airplanes, over 150,000 soldiers, and all the supplies required for the D-Day invasion. General Eisenhower relied on information from weather forecasters and other scientists to determine the best time to successfully invade. One of the six meteorologists, Lawrence Hogben stated, "The outcome of D-Day, perhaps the whole future of the western world rested on those forecasts . . ."

In this program, students will examine primary source artifacts to evaluate the conditions on D-Day and either support or refute Eisenhower's decision to allow D-Day to commence June 6, 1944.

## TARGET AUDIENCE

Grades 6 - 12

## OBJECTIVES

- Students will gain an understanding of the overall objective of D-Day, primary sources, and the importance of the environmental conditions surrounding D-Day.
- Students will evaluate primary sources to determine for themselves if they agree with General Dwight D. Eisenhower's decision to commence D-Day on June 6, 1944.

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**TIME REQUIREMENT:** 1 Hour

## ACKNOWLEDGEMENTS

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Thanks to the Dane G. Hansen Foundation for funding and Cliff Lawson at the Radiosonde Museum of North America ([www.radiosondemuseu.org](http://www.radiosondemuseu.org)) and the Eisenhower Presidential Library, Museum and Boyhood Home for primary sources.

# Core Standards

## NATIONAL CURRICULUM STANDARDS

All lesson plans meet numerous national Common Core State Standards for Literacy in History/Social Studies, Science and Technical Subjects, as well as National Curriculum Standards for Social Studies.

	Common Core State Standards	6th - 8th	9th - 10th	11th - 12th
Standard	<b>RI</b> - Reading Informative Text	1-4, 7	1-4, 7, 9	1-4, 7
	<b>W</b> - Writing	1, 7-9	1, 7	1, 7
	<b>SL</b> - Speaking and Listening	1, 2, 4	1, 4	1, 4
	<b>RH</b> - History/Social Studies	1, 2, 7-9	1, 2, 6-9	1, 2, 6-9

National Curriculum Standards for Social Studies			
Theme	<b>2</b> - Time, Continuity, and Change	6-8	9-12
	<b>3</b> - People, Places, and Environments	6-8	9-12
	<b>8</b> - Science, Technology, and Society	6-8	9-12

# Lesson Plan

1. Ask students to share about an event they were looking forward to that was dependent on the weather. Share an example of your own. (Examples: outdoor concert, softball tournament, etc.) What if that event determined the fate of millions of people?

3 minutes

2. Use **The Purpose of D-Day** (page 5) to instruct students about the overall purpose of D-Day.

3 minutes

3. Use **Primary Sources: Preserving the Past** (page 6) to instruct students about the importance of primary sources and how to engage with them.

3 minutes

4. With students in groups of 2-3, examine primary source #1.6 (weather balloon) and guide them through filling out a **Primary Source Analysis** (page 7) sheet together.

\* Each group should have its own copy of the primary source.

8 minutes

5. Use the **Background Briefing** (pages 8-9) to explain and discuss the significance and challenges of the weather conditions surrounding D-Day. What were the ideal weather conditions for D-Day? How did General Eisenhower and his team prepare to make the best decisions?

5 minutes

6. In groups of 2-3, have students examine the other primary sources in the set (each group gets the same set). Select one primary source for each group to focus on to fill out a **Primary Source Analysis** (page 7) sheet.

\* After filling out the analysis sheets, each group shares their findings about their “focus object” with the class. Refer to the **Primary Source Set: 1. WEATHER** (page 10) to help determine if students correctly interpret the source.

20 minutes

10 min analysis/10 min sharing

7. Use **Commence or Delay** (page 11) to instruct students about the timeline of events leading up to Eisenhower’s decision. Each individual student is now asked to decide if, based on this information, they would commence with D-Day or delay, and explain why. Visually represent the students’ votes by asking students to get up and move to either side of the room, depending on their vote.

5 minutes

8. Use the information provided on **The Reality** (page 12) to read about and show the video clip of what the weather conditions were actually like on D-Day. Discuss student reactions.

5 minutes

9. If there is extra time, have students complete the **Countdown Assessment** (page 13). If time is out, send it home for the students to complete and hand in to their teacher.

# The Purpose of D-Day

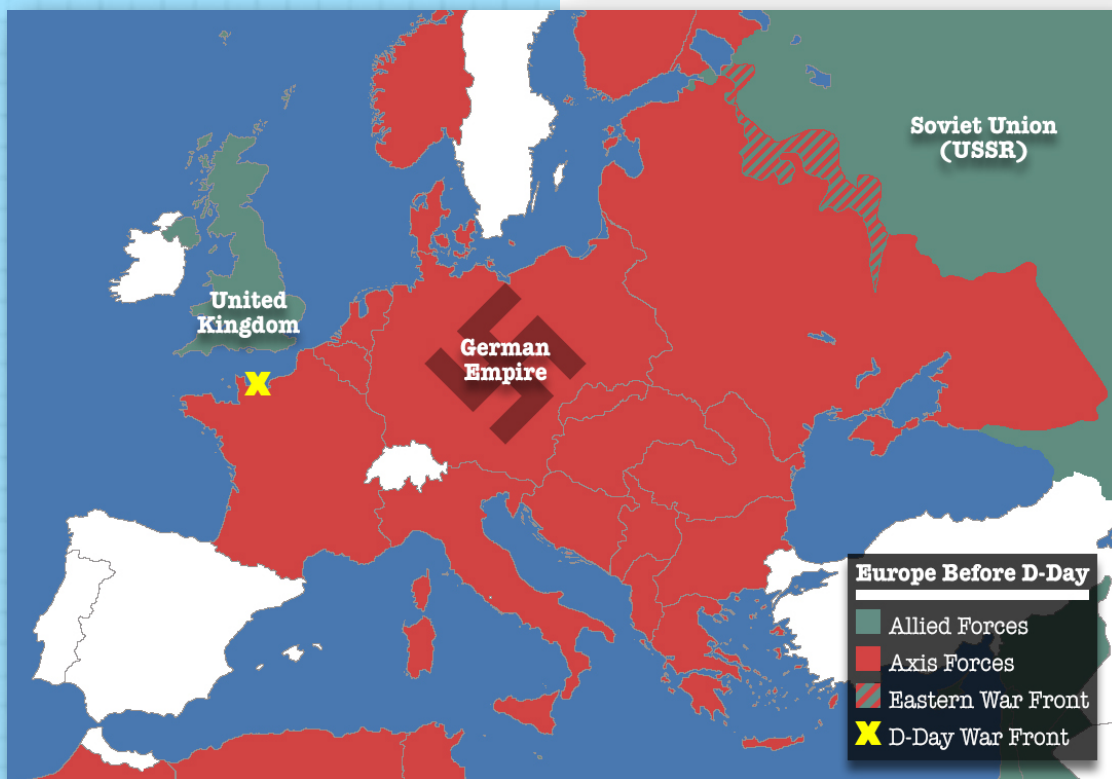
## OVERVIEW

The D-Day invasion of World War II was codenamed Operation Overlord. Its purpose was to establish a safe entry point into Europe for the Allied Forces, and force Nazi Germany to fight on two fronts.

Germany had already conquered most of Western Europe, which allowed Germany's Nazi dictator, Adolf Hitler, to invade the Soviet Union to his east. Allied leaders believed that Hitler's forces could be defeated if the Nazi's had to split their resources and fight on two fronts. Therefore, Allied invasion plans were made to attack on the Normandy beaches of Nazi-occupied France.

## DID YOU KNOW?

"D-Day" is a military term used to mean the date on which any military operation will begin. The day before D-Day is known as "D-1," while the day after D-Day is "D+1," and so on. This done so that a projected date of an operation can change, but the plan does not also need to be changed. The term "H-Hour" is also used to refer to the time an operation will begin. The WWII invasion at Normandy is simply the most well-known D-Day.



# Primary Sources: Preserving the Past

## A WINDOW TO THE PAST

What is a **primary source**? It is any direct evidence produced during a specific period under study. They vary widely from objects like photographs, diaries, and maps, to movies, songs, and eyewitness accounts. The key is that they were created when the time period being studied actually happened.

A primary source is different from a **secondary source**, which is an analysis of the history. History text books are typically secondary sources because the authors were not present at the time in history they are writing about, but are interpreting what they have learned about the event.

This is what makes learning with primary sources so bountiful -- students get to hold a real piece of history in their hands and come up with their own conclusions about its significance. The answers are not always provided by the primary sources, encouraging students to seek the answers through additional research.

In this lesson, students will use copies of the **Primary Source Analysis** sheet to investigate the provided primary sources, using the following four steps. Look at the first primary source together as a class, then, do the second set with a partner or small group.



## INVESTIGATING

1. Students first simply observe the primary source to make note of its details.

It is made out of ...

It has the date ...

2. Next, students draw on their prior knowledge.

This looks like ...

I remember seeing a similar ...

3. From this, students need to make speculations about the primary source.

Its purpose might have been to ...

I bet it was made by ...

4. Students ask questions about the primary source in order to direct further exploration.

Who was ...

Why does this ...

## FURTHER RESEARCH

If time and resources permit, students can apply the following steps:

5. Next, students begin testing their speculations with research and analysis skills. In order to do this, they use other sources of information (internet, experts, etc.) to find answers based on the clues provided by the primary source.

6. Finally, students summarize and share what they have learned about the past through the primary source.

# Primary Source Analysis

**PRIMARY SOURCE #** \_\_\_\_\_

<p><b>OBSERVE</b> the primary source, making notes of its details.</p> <p>It is made out of . . . It has the markings . . . Color . . .</p>			<p><b>CONNECT</b> the primary source to prior knowledge.</p> <p>This looks like . . . I have seen something similar . . .</p>
<p>Develop <b>QUESTIONS</b> about the primary source in order to direct further exploration.</p> <p>Who was . . . Why does this . . .</p>			<p>Make <b>SPECULATIONS</b> about the primary source.</p> <p>Its purpose might have been . . . I bet it was made by . . .</p>



# Primary Source Analysis

**PRIMARY SOURCE #** \_\_\_\_\_

<p><b>OBSERVE</b> the primary source, making notes of its details.</p> <p>It is made out of . . . It has the markings . . . Color . . .</p>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>CONNECT the primary source to prior knowledge.</p> <p>This looks like . . . I have seen something similar . . .</p>
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# Background Briefing

## INTRODUCTION

General **Dwight D. Eisenhower** was chosen to be the Supreme Allied Commander in charge of D-Day. He knew from the start that the effects of the weather on the invasion would be complicated. Add that on top of the massive planning required to coordinate some 156,000 American, British and Canadian forces to carry out surprise landings on five different beaches along a 50-mile stretch of the heavily fortified coast of France's Normandy region, as well as the paratroopers and bombs being dropped from 11,590 aircraft into enemy territory. And all of the supplies -- from food to weaponry to spare jeeps parts -- that were required to make the invasion a success! The amount of planning and coordination required was staggering. The decision was on Eisenhower's shoulders to determine when the weather would best permit a successful invasion.

If there were high **winds**, there would be high waves, making the landing crafts carrying the men to shore difficult to handle in the rough seas. These conditions could create a variety of problems -- landing in the wrong area, boats capsizing, or soldiers being too sea-sick to fight well once they were on the beach. In addition, paratroopers and gliders that needed to be dropped into specific areas to attack supply lines would be blown off course.

If there was low or dense **cloud cover**, visibility was decreased for the airplane pilots who needed a clear line of sight to accurately drop the paratroopers and bombs.

The **tide**, which is controlled by the **moon**, was also critical. When the tide was high, soldiers could not see the many mines, tank

traps and obstacles placed on the beaches by enemy German forces. The tide was lowest when there was a full or new moon. Having a full moon was the best because it would increase visibility for the paratroopers, gliders, and bombers during the pre-dawn hours of the invasion. Unfortunately, during a new or full moon, the odds of having high winds and cloud cover were tripled.

## IDEAL D-DAY WEATHER

Several weather elements had to be just right at the same time in order for the invasion to have the best chance of success. The English Channel was known to have erratic and unpredictable weather, especially in the spring. The following is a simplified list of the ideal weather conditions for D-Day to commence:

- A.** D-Day must be within the period of one day before to four days after a new or full **moon** to ensure a low **tide**.
- B.** For naval landings, D-Day must be "quiet" and followed by a sequence of three "quiet" days.
  - \* "Quiet" = surface **wind** not to exceed Force 3 (8-12 mph) onshore and Force 4 (13-17 mph) off-shore.
- C.** For airborne troops, paratrooper **winds** should not exceed 20 mph and paraglider winds should not exceed 30 mph.
- D.** **Cloud** cover must not exceed 60% with a base higher than 3,000 feet. Visibility for at least three land miles is necessary.

## CHALLENGES

In 1944, weather forecasting was fairly primitive. There was no satellite or radar technology available to meteorologists like there is today. Weathermen used the following list of tools and techniques to gather information about pressure, humidity, temperature, visibility, precipitation and clouds:

1. Observation stations on land and at sea
2. Observations from long-range aircraft
3. Radio-sondes on weather balloons
4. Radio interceptions of German weather observations.

The above four sets of information were then plotted on charts which enabled forecasters to draw weather patterns and estimate the future weather. Using these techniques, meteorologists were only able to prepare detailed charts every six hours. A generalized forecast could be given 48 hours out, but a more accurate, detailed forecast was only obtainable 18 hours out. This posed a great complication because Allied ships coming from bases in northern Britain required a week of travel time to get to the mid-English Channel assembly area. Eisenhower knew that once all those ships were seen assembled, the enemy would know an invasion was imminent and any element of surprise would be lost.

## PREPARATION

On November 30, 1943, President Roosevelt, Prime Minister Churchill, and Premier Stalin agreed that the D-Day portion of Operation OVERLORD should occur around May, 1944. Soon after, a meteorological team was established at SHAEF to serve General Eisenhower. Three leaders from the meteorological team, James Stagg (British Royal Air Force), Don Yates (U.S. Army Air Force), and John Fleming (British Royal Navy) reported directly to Eisenhower.

The team studied weather patterns from past years, poured over charts and maps, and conferred twice a day, coordinating information from three different forecasting teams. Once a week, Stagg led the briefing to Eisenhower and his commanders. As May went by, these “Stagg Reports” increased to daily and then twice daily.

Interestingly, these meetings became a weekly dress rehearsal of sorts for D-Day. Each Monday morning, a forecast was given for the upcoming week considering Thursday as the “dummy D-Day.” General Eisenhower would then go through the steps of deciding whether the weather around that D-Day would be suitable to commence the invasion. As the week progressed, the team analyzed the accuracy of their forecast and how the decision Eisenhower made would have unfolded.

“[There was] a feeling of great pride for those of us who had watched the dress rehearsals -- to see the actual performance -- to see the same actors performing so confidently even under unimaginable strain of all this too real and momentous occasion.”

-Harold R. Bull



# Primary Source Set

## 1. Whether the Weather Matters

Number/Type	Description
1.1 DOCUMENT	<p><b>Technical Manual No. 3-240, "Meteorology"</b> Manual describing the influence of weather on military operations. * Encourage students to consider the important role weather plays when planning any military operation.</p>
1.2 PHOTO	<p><b>Omaha Beach LCVP</b> US Army's First Division on the morning of June 6, 1944 at Omaha Beach, France. Soldiers are getting out of a LCVP (Landing Craft, Vehicle, Personnel) from the U.S. Coast Guard-manned USS Samuel Chase and trying to make it to shore. * Encourage students to note the weather conditions observed in the photo (waves, tide, visibility).</p>
1.3 PHOTO	<p><b>Normandy Invasion</b> Omaha Beach during the afternoon of June 6, 1944. * Encourage students to note the scene observed in the photo (beach obstacles, weather conditions, barbed-wire, vehicles).</p>
1.4 DOCUMENT*	<p><b>'OVERLORD' The Effect of Weather</b> Secret military document describing the weather requirements necessary for D-Day to occur. * Remind students that this is the real document prepared by the military outlining the effect of weather on D-Day.</p>
1.5 DOCUMENT*	<p><b>Behind the Scenes with the OVERLORD Weathermen</b> Written in 1960 by Harold R. Bull, a general in the U.S. Army who served as Assistant Chief of Staff for SHAEF. The meteorological staff was included in his office. * Remind students that this is a first-hand account by someone who was intricately involved in planning and implementing D-Day.</p>
1.6 ARTIFACT*	<p><b>150 Gram Weather Balloon</b> Filled with helium or hydrogen, weather balloons can reach altitudes exceeding 115,000 feet. They carry a device called a radiosonde. * Remind students that this was the best technology that existed to aid meteorologists in compiling weather data and forecasting the weather for D-Day.</p>
1.7 ARTIFACT	<p><b>Radiosonde Modulator ML-310 I/AMT-1</b> 1950s US Army Signal Corps weather balloon radiosonde modulator that measured temperature, pressure and humidity and transmitted this data to a receiving station. * Remind students that this was the best technology that existed to aid meteorologists in compiling weather data and forecasting the weather for D-Day.</p>
1.8 ARTIFACT	<p><b>Radiosonde Recording Box</b> This box houses the many components of the radiosonde and is attached to the weather balloon and parachute. The outside of the box explains return mailing instructions * Remind students that this was the best technology that existed to aid meteorologists in compiling weather data and forecasting the weather for D-Day.</p>

\* For practical purposes, replicas or facsimiles of the originals are being used with students.

# Primary Source Set Cont.

<p><b>1.9</b> COMIC BOOK</p>	<p><b>Capt. Ben Dix in Action with the “Invisible Crew”</b> 1943 Comic book promoting Bendix Aviation products, including the radiosonde on page 10. On loan from Cliff Lawson at the Radiosonde Museum of North America (<a href="http://www.radiosondemuseu.org">www.radiosondemuseu.org</a>) We are using replicas of the cover and page 10 with students.</p>
<p><b>1.10</b> ADVERTISEMENT</p>	<p><b>“First Line of Defense Against Man’s Oldest Foe”</b> 1945 Bendix RaySonde advertisement. Possibly in <u>Fortune</u> magazine. On loan from Cliff Lawson at the Radiosonde Museum of North America (<a href="http://www.radiosondemuseu.org">www.radiosondemuseu.org</a>) We are using replicas with students.</p>
<p><b>1.11</b> ADVERTISEMENT</p>	<p><b>“Weatherman of the ‘Invisible Crew’”</b> May 17, 1943. Bendix RaySonde advertisement. From <u>Time</u> magazine. On loan from Cliff Lawson at the Radiosonde Museum of North America (<a href="http://www.radiosondemuseu.org">www.radiosondemuseu.org</a>) We are using replicas of the cover and page 10 with students.</p>
<p><b>1.12</b> ARTICLE</p>	<p><b>“Radio-Balloons to provide secret weather data for the Allies”</b> March 23, 1940. <u>The Illustrated London News</u>. Page 379. Written by L.N.A. On loan from Cliff Lawson at the Radiosonde Museum of North America (<a href="http://www.radiosondemuseu.org">www.radiosondemuseu.org</a>) We are using replicas with students.</p>
<p><b>1.13</b> ARTICLE</p>	<p><b>“Raysonde: Electronic Weather Eye”</b> page 256. <u>Current Aviation</u>. May 8-12, 1944. No author named. On loan from Cliff Lawson at the Radiosonde Museum of North America (<a href="http://www.radiosondemuseu.org">www.radiosondemuseu.org</a>) We are using replicas with students.</p>
<p><b>1.14</b> DOCUMENT</p>	<p><b>“Conditions in Normandy”</b> by General Eisenhower, June 3, 1944 Obtained from: DDE’s Pre-Presidential Papers, Box 137, Crusade in Europe (Documents) (3) in the Eisenhower Presidential Library</p>
<p><b>1.15</b> DOCUMENTS</p>	<p><b>Weather Charts, June 1-6, 1944</b> Taken from <u>Forecast for Overlord</u> by James Stagg (Littlehampton Books, 1971.). Weather charts showing the weather happening on these crucial days. * Explanatory information is given out with these charts to help students translate them. Remind students that information from radiosondes and observations went to meteorologists who created these charts.</p>

# Commence or Delay?

After all the preparation and dress rehearsals, it was time . . .

May 23, 1944

General Eisenhower announced D-Day was set for June 5th, with the 6th and 7th as alternatives. These dates offered the best conditions for the invasion because there would be a full-moon and therefore low-tides, as well as a forecast of light winds and clear to partly cloudy skies.

May 25, 1944

Eisenhower directed naval commanders to open their operation orders which would send them to the mid-English Channel assembly area. Army and Air Force commanders were directed to have final preparations done by May 31st. This put all forces in position and on the ready to commence the invasion when they were notified of the exact D-Day.

May 29 - June 2, 1944

Winds were quiet, but cloud cover was increasing. By June 2nd, forecasters predicted deteriorating weather conditions and the commanders were growing anxious.

June 3, 1944

The forecast projected winds would be up to Force 5 in places, with 100% cloud cover only 500 feet above sea. This weather would not work for naval or airborne forces. Eisenhower faced an enormous decision with colossal consequences.

June 4, 1944

**Morning**  
Eisenhower decided to delay the invasion on a day-to-day basis due to the poor weather. If this bad weather persisted through June 7th, the whole invasion would have to be postponed until the next possible dates, June 17 - 19th.

**Evening**  
General Eisenhower and his team met to re-evaluate. New weather reports detected a front moving towards the invasion area that should cause a temporary clearing of the weather the morning of June 6th.

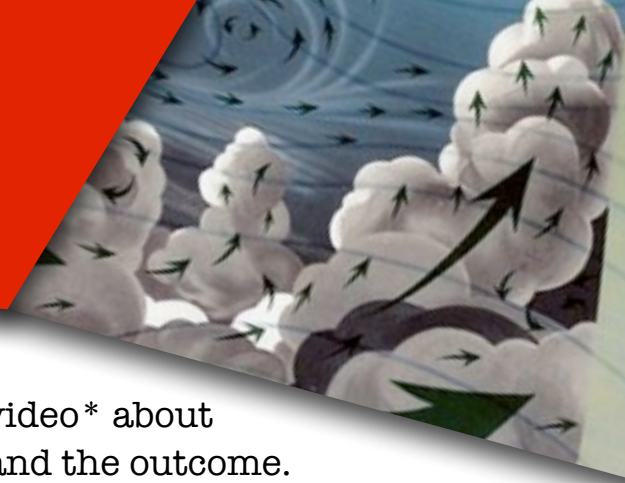
If Eisenhower chooses to delay past June 7th, the element of surprise might be lost. If he chooses to commence and the weather conditions are poor, hundreds of thousands of lives could be lost and the Allies will most likely fail to establish a second war front to split Nazi forces and liberate Europe. Based on the information you have been given, put yourself in Eisenhower's shoes. More than 150,000 soldiers, airmen, and sailors are anxious and ready to go.

Is your decision to:  **COMMENCE** or  **DELAY?**

Explain your decision below.



# The Reality



Read the following information and watch a short video\* about D-Day weather conditions, Eisenhower's decision, and the outcome.

## June 5, 1944

After much debate into the early hours of June 5th, Eisenhower issued orders to commence the invasion on June 6, 1944.

## June 6, 1944

### Morning

As the invasion began, the weather was just tolerable. The previous day's storm left waves five to six feet high which caused some loss of landing crafts and tanks. The wind and clouds permitted paratroopers and gliders to be dropped, and most bombings to occur, however, not with the best accuracy.

### Evening

By day's end, the Allies had gained a foot-hold in Normandy. The cost was high -- more than 9,000 Allied soldiers were killed or wounded -- but more than 100,000 soldiers began the long, heroic struggle to establish an Allied beach head and a new war front. The hard fought invasion was a success -- Eisenhower had made the right decision.

## June 11, 1944

By the end of June 11th, 326,547 troops, 54,186 vehicles and 104,428 tons of supplies had landed on the beaches and were on their way to liberate Europe from Nazi tyranny.



The German's forecasters believed the weather conditions were too bad for the invasion to occur in early June. As a result, sea and air patrols of the English Channel had been cancelled, and many German officers were released on a break. Even Adolf Hitler had taken a sleeping pill with orders not to be disturbed.

The D-Day invasion -- and therefore the war in Europe -- would have had a very different outcome had Eisenhower chosen to delay until the next available date, June 17th. On that day, the worst storm in twenty years struck the English Channel!

\*



\* Scan the QR code above or go to [EisenhowerMemorial.org](https://www.eisenhowermemorial.org) to view the video "D-Day: The Decision That Changed the World."

# Countdown Assessment



Complete and hand in the following Countdown Assessment.

**5**

Statements about the importance of the weather conditions surrounding D-Day.

- 
- 
- 
- 
- 

**4**

Facts you learned about D-Day.

- 
- 
- 
- 

**3**

Facts that are true about primary sources.

- 
- 
- 

**2**

Questions you still have about the topic.

- 
- 

**1**

Interesting thing you learned.

-

# Sources

The following are recommended sources of content, primary sources, or artifact replicas suitable for classroom use.

## **Eisenhower Presidential Library (National Archives), Abilene, Kansas**

Bull, Harold R.: Papers, 1943-1968. Box 3.  
Supreme Headquarters, Allied Expeditionary Force, and Chief of Staff, Supreme Allied Command, Office OF G-3 (Harold R. Bull): Records, 1943-46 [microfilm]. Box 1, Reel 1. Meteorological Data [1191-1208].  
WORLD WAR II PARTICIPANTS AND CONTEMPORARIES: Papers.  
Bates, Charles C.: Swell Forecast Section Final Report (1)-(4).  
Howell, John R.: Papers  
Pettersson, Sverre: Memoirs

## **Books**

Ambrose, Stephen. The Supreme Commander: The War Years of Dwight D. Eisenhower. New York: First Anchor Books, 2012.  
Eisenhower, Dwight D. Crusade in Europe. New York: Doubleday, 1948.  
Eisenhower, Dwight D. At Ease, Stories I Tell to Friends. New York: Doubleday, 1967.  
Petterssen, Sverre. Weathering the Storm: Sverre Petterssen, the D-Day Forecast, and the Rise of Modern Meteorology. American Meteorological Society, 2001.  
Pogue, Forrest C. The Supreme Command. US Army in World War II Series. Washington DC: Office of the Chief of Military History, Department of the Army, 1954.  
Smith, Walter Bedell. Eisenhower's Six Great Decisions. New York, Longmans, Green and Co., 1956.  
Stagg, J.M. Forecast for Overlord. Sussex: Littlehampton Book Services, 1971.

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