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BULLETIN

**Navigating Conflict: The Strategic Significance and Evolution
of Navigation Techniques in the Azores Islands during World
War I and World War II**

Student Voices

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Abstract

Situated strategically in the Atlantic Ocean, the Azores Islands emerged as pivotal theaters during World War I and World War II and profoundly shaped these global conflicts through its geographic significance and technological advancements. In this paper, the evolution of navigation techniques, routes, and the strategic importance of the Azores according to the changing nature of warfare was analyzed. Through an examination of historical narratives and technological progress, insights were made into how the islands developed into critical hubs for naval and air operations. Advancements in airport infrastructure, telecommunications, and harbor facilities transformed the Azores into essential nodes for transatlantic shipping, communication networks, and surveillance in the Atlantic theater. Navigational strategies, informed by technological innovations, optimized air routes and access to strategic bases which bolstered military capabilities in both conflicts. Through the exploration of the relationship between technological progress, evolving warfare dynamics, and geopolitical significance, the enduring impact of the Azores Islands on shaping global conflicts throughout history was revealed.

Introduction

The Azores Islands, nestled in the vast expanse of the Atlantic Ocean, served as a pivotal theater during the tumultuous periods of World War I and World War II. Beyond their picturesque landscapes and azure waters, these islands played a strategic role, influencing the course of naval and aerial operations. This paper aims to investigate the advancement of navigation techniques and navigational routes used in World War I and World War II in the Azores Islands according to the changing nature of warfare.

The research methodology included a comprehensive review of existing literature pertaining to this topic, supplemented by an analysis of historical maps obtained from repositories including the David Rumsey Map Collection, the Perry-Castañeda Library Map Collection, the James Ford Bell Library, and the Lloyd Reeds Map Collection. Moreover, the methodology involved searching for historical maps that could provide insight into the concurrent historical events aligning with the findings in the literature. Utilizing primary sources such as historical maps provided a firsthand glimpse into the geographical landscape and strategic considerations of the Azores Islands during World War I and World War II. This provided invaluable insights that deepened the understanding of navigational strategies and their pivotal role in shaping wartime operations.

The exploration of navigation techniques and routes in the Azores during the wars unveiled an intricate relationship among technological advancements, evolving warfare strategies, and the geopolitical importance of these islands. The significance of this complex relationship lies not only in the geographical importance of the Azores, but also in how these advancements were complexly intertwined with the dynamic shifts in warfare during both World Wars. Examining this historical narrative highlighted advancements in maritime and aerial navigation technologies, underscoring the interconnected relationship between evolving warfare and the navigational demands of military forces that defined the Azores Islands' role in global conflicts.

Background

The combined landmass of the Azores archipelago, formed by the nine islands illustrated in Figure 1, had a population of approximately 234,530 in 1920 after the end of World War I (Santos, 2011) and an estimated 287,000 people in 1941 in the middle of World War II (Herz, 2014). The archipelago comprises of islands named Santa Maria, Terceira, São Miguel, Graciosa, Pico, São Jorge, Corvo, Faial, and Flores.

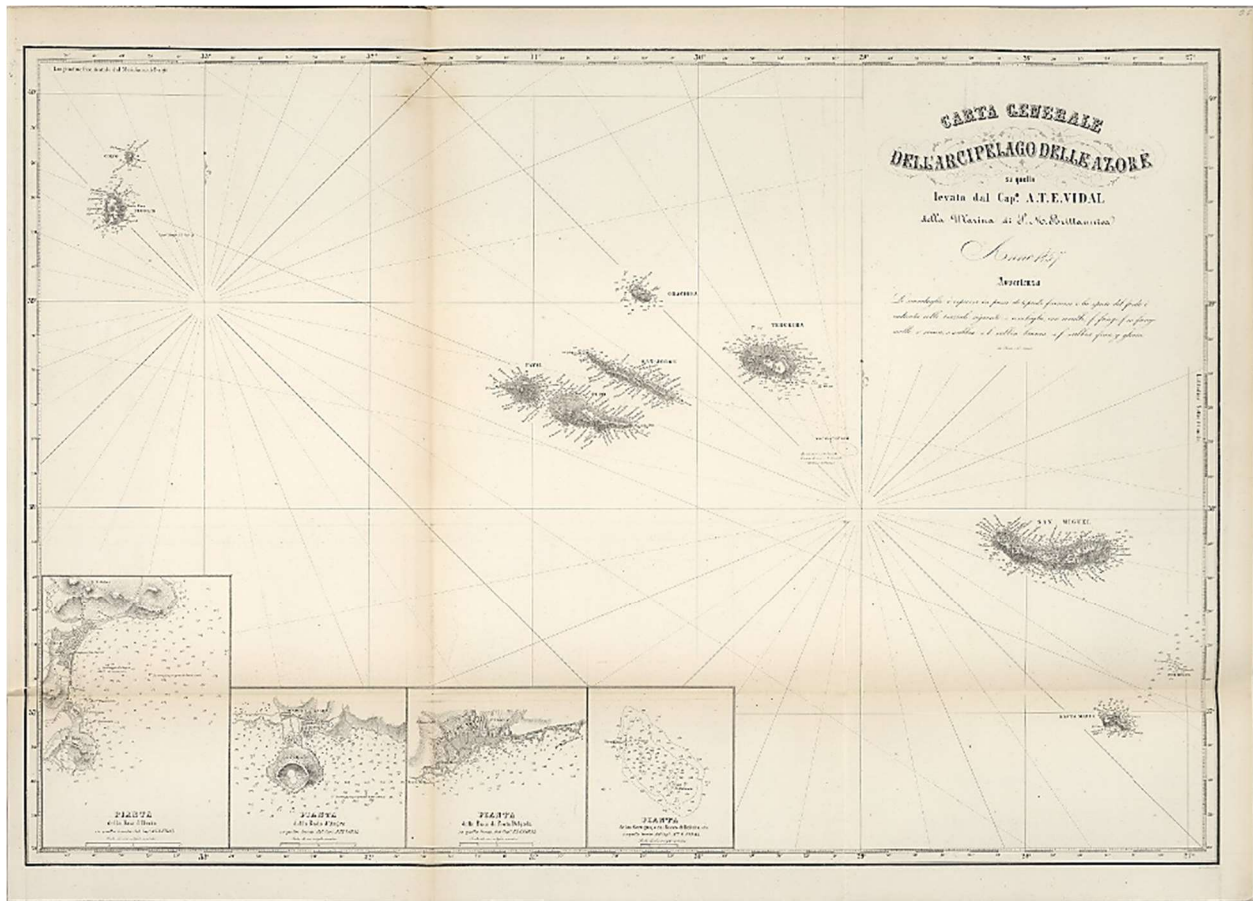


Figure 1: A comprehensive maritime atlas of Brazil and the South American Atlantic coast, crafted by Eugenio Rodriguez. This initial edition of the Atlas volume includes two accompanying text volumes. The maps contained within the Atlas were meticulously prepared by navigators and hydrographers under the supervision of Baron Roussin for Eugenio Rodriguez (Rodriguez, 1857).

The credit for the discovery of the Azores islands is frequently attributed to Gonçalo Velho Cabral, a Portuguese explorer who, in 1432, is said to have stumbled upon the archipelago while being off course during his return journey from Africa (Santos, 2011). Nevertheless, the existence of several pre-existing maps suggests a reasonably accurate, albeit not flawless, understanding of the location and makeup of the Azores archipelago before Cabral's landings. Figure 2 represents an example of the earliest portolan, or nautical, chart in the James Ford Bell Library that was made in 1424 by a Venetian cartographer named Zuane Pizzigano (James Ford Bell Library, n.d.).



Figure 2. The earliest portolan chart in the James Ford Bell Library, created in 1424 by Venetian cartographer Zuane Pizzigano. This manuscript chart on vellum measures approximately two by three feet in size. The 1424 Nautical Chart is characterized by its simplicity, lacking pictorial decoration and a separate decorated compass rose (James Ford Bell Library, n.d.).

The settlement of the Azores was never motivated by colonization for demographic growth or wealth accumulation, given the islands' limited resources and size (Littleton, 2022). Instead, the islands served as a crucial waystation, assisting expansion abroad. Historically, the Azorean economy depended on agricultural activities, with a specific focus on dairy farming, tobacco cultivation, and the growing of pineapples (Beier & Kramer, 2018).

The exploration of the historical connections between the archipelago and mainland Portugal, as well as America, provides insights into the strategic significance of the Azores in military warfare. This analysis highlights the pivotal role of the Azores as a strategic outpost and staging area for military operations which revealed its importance in shaping military strategies and alliances during past historical conflicts (Littleton, 2022).

Strategic Significance of the Azores Islands during World War I

The Azores Islands held strategic significance during World War I due to their geographical location in the North Atlantic. They served as a crucial midway point between North America and Europe, making them strategically positioned for naval operations and communication lines. The

inaugural commander of U.S. naval forces stationed at the U.S. Naval Base in Ponta Delgada, Rear Admiral Herbert Dunn, distinctly outlined the strategic importance of the Azores in an entry written in 1917 (Rezendes, 2021). He specifically highlighted the significant harbor capabilities of Ponta Delgada and Horta (on Faial Island), underscoring their potential to serve as crucial sites for ship supply, ship repair facilities, and coaling stations (Rezendes, 2021).

Admiral Dunn emphasized that the strategic significance of occupying the Azores stemmed from the potential threat it posed if controlled by the enemy. The islands could have served as an ideal submarine base, posing a considerable obstacle to the successful transportation of troops and supplies across the ocean, given the proximity of convoy routes passing north and south of the archipelago (Daniels, 1922; Rezendes, 2021). They provided a potential base for naval forces, allowing control over important sea routes and acting as a refueling and repair station for ships. Controlling the Azores meant influence over key Atlantic shipping lanes. This was particularly significant in an era when maritime trade and the movement of naval fleets were paramount.

When WWI began in 1914, the Portuguese navy was outdated and limited in size, rendering it unable to confront a modern adversary directly. This inadequacy resulted from years of underinvestment, neglect, and continuous political instability (Ribeiro de Meneses, 2023). The few warships at the country's disposal were ill-equipped for a direct encounter with enemy surface vessels, lacking both mine-sweeping equipment and depth charges. Consequently, they were powerless against enemy submarines.

The initial indications of German submarine activity in the Azores emerged in 1915, heightening concerns among Azorean military authorities. Despite having communicated their presence to the Portuguese Ministry of War and the Navy at the onset of the conflict, the growing signs of German submarines in the region intensified anxieties among the Azores' military leadership (Rezendes, 2021). The German U-boat SM U-83 conducted a bombing raid on the harbor of Funchal in Madeira on December 3, 1916 (Hughes, 2020). This event triggered a series of developments that culminated in the bombing of Ponta Delgada by SM U-155 on July 4, 1917 (Hughes, 2020). The motive behind the latter attack was likely an attempt to destroy a coal depot, primarily utilized by U.S. ships for refueling and resupplying during their operations in the Atlantic Ocean region.

Following an agreement with Britain, the United States took on the responsibility of defending the Azorean Sea. The defense of this region was essential for safeguarding the passage of ships from the United States to Europe, North Africa, and the Mediterranean Sea (Work, 2004).

These routes were vital for commercial shipping heading to Britain and other Allied nations, transporting essential supplies such as foodstuffs and provisions from Africa, South America, and regions beyond Cape Horn and the Cape of Good Hope (Ponce, 2014). Other important supplies included military equipment, ammunition, food, medical supplies, and other provisions that were necessary to support the Allied forces engaged in combat operations. It was also important to protect crucial resources such as fuel and coal deposits, a German prisoner-of-war camp, wireless stations, telegraph cable hubs, and the local population itself (Work, 2004). As depicted in Figure 3, the Azores Islands became crucial for telegraphic communications due to their geographical location during WWI, whereas before the war its potential as a midway point in the Atlantic Ocean was not as evident.

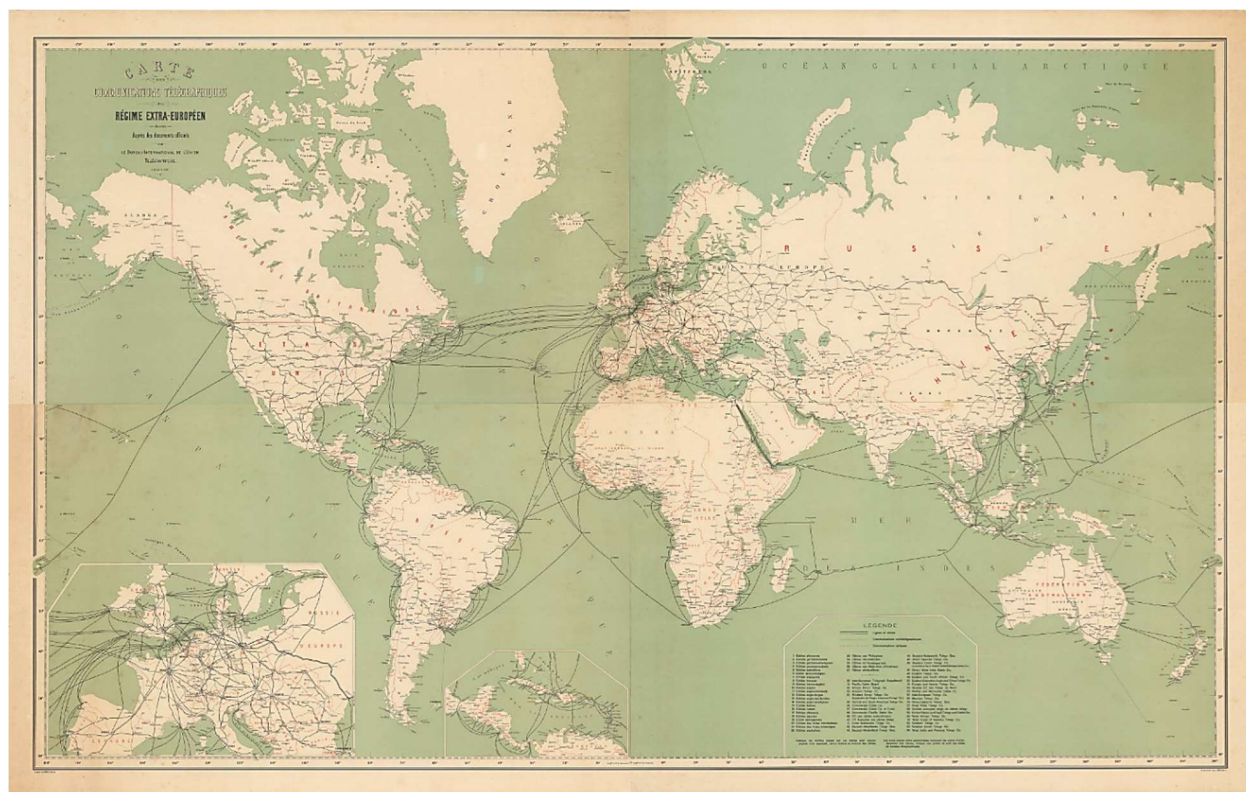


Figure 3. A map illustrating telegraphic communications in the non-European territories, compiled from official documents by the International Bureau of Telegraphic Administrations. This map is the only unrecorded World War I edition of the official map of the global telegraph system (Hoven, 1917).

Navigation Techniques utilized during World War I in the Azores

Various navigation techniques were employed to facilitate naval and aerial operations during World War I. Celestial navigation continued to be a fundamental technique. Navigators relied on the positions of the sun, moon, stars, and planets to determine their location and course. While celestial navigation in the air was not considered a top military precedent, the development and production of instruments for this purpose were significantly influenced by military demand (Warner, 2005). This demand originated during World War I and continued to increase steadily in the years between the wars.

Dead reckoning was also used during the war, and it involved estimating a current position based on a previously known position, course, and speed. This method was commonly used in both naval and aerial navigation. Navigating through dead reckoning in the air during the first World War presented a distinct challenge and danger compared to navigation from the Earth's surface (Williams, 1984). The challenge posed by navigating through dead reckoning in the air was clear to pilots and navigators who had to contend with various factors such as the lack of visual references over vast expanses, variable atmospheric conditions affecting accuracy, limited technology compared to modern systems, the rapid movement of aircraft exacerbating errors, and the increased risk of getting lost over unfamiliar terrain or adverse weather conditions.

Detailed charts and maps were still crucial for plotting courses, avoiding obstacles, and understanding geographical features. These charts were often updated with the latest intelligence on enemy positions and sea conditions. Additionally, the use of radio navigation became more prevalent during WWI (Schroer, 2003). Radio signals, including radio direction finding, were employed for navigation and communication in the Azores. The combination of these navigation techniques showcased the adaptability of military navigators during World War I in the challenging and strategically significant region of the Azores Islands.

The changing nature of warfare in World War I, marked by the introduction of submarine warfare and the utilization of naval and air patrols, had a profound impact on navigational strategies and routes in the Azores Islands. The presence of enemy submarines in the waters surrounding the Azores Islands necessitated the alteration of traditional navigation routes (Ponce, 2014). Navigators had to consider the potential threat of submarine attacks and choose routes that minimized exposure to these underwater hazards.

The Germans aimed to deal a significant blow to the British economy by targeting these islands tactically positioned along crucial trade routes. The deployment of naval and air patrols around the Azores increased surveillance capabilities. Navigators had to factor in the presence of patrols when planning routes and adjust strategies based on potential encounters with friendly or enemy forces. The development of radio navigation technology, including radio direction finding, became crucial in the Azores. This technology allowed for more accurate navigation, communication, and the detection of enemy signals. Navigators in the Azores had to prioritize accurate weather forecasting as well due to the changing nature of warfare since meteorological information was essential for planning routes, avoiding adverse weather conditions, and ensuring the safety of naval and aerial operations.

Technological Advancements Between World War I and World War II

The period between World War I and World War II witnessed significant technological advancements globally, and the Azores Islands were no exception. While not as directly involved in the conflicts as other regions, the strategic importance of the Azores influenced the development and adoption of various technologies. The Azores saw improvements in airport infrastructure, including runway expansions, and the development of air facilities (Dennis, 1994). This was crucial for the increasing role of aviation in military and civilian activities.

Advancements in telecommunications technology led to the improvement of communication networks in the Azores. Enhanced telegraph and radio communication systems played a vital role in military coordination and intelligence gathering (van der Vleuten & Kaijser, 2005). During World War I, the Portuguese government effectively brokered collaboration with Great Britain, recognized as a significant strategic ally. The Portuguese objective was to establish a mutually beneficial arrangement where the British transatlantic telegraph companies would utilize Lisbon, the Azores, and Cape Verde as relay stations (van der Vleuten & Kaijser, 2005). Concurrently, the Portuguese government sought to establish communication links with its colonies, a goal for which it lacked the financial and technical resources.

Additionally, upgrades to harbor facilities were made to accommodate larger and more advanced naval vessels, reflecting advancements in maritime transportation. As illustrated in Figure 4, mail routes and steamship routes developed after World War I and the Azores Islands became

geographically important in terms of infrastructure and transportation routes across the Atlantic Ocean.

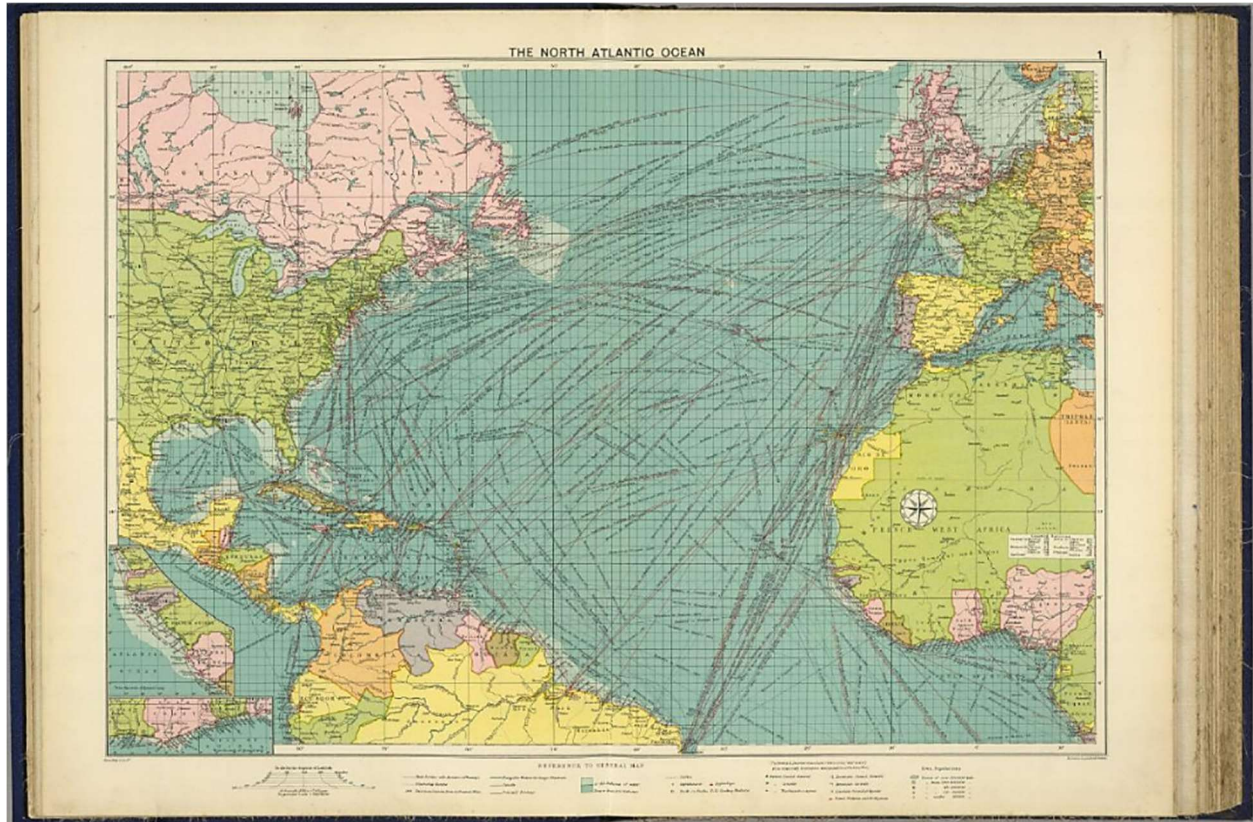


Figure 4. This color lithographed map features two insets depicting portions of West Africa. The map illustrates mail routes and their durations, steamship routes, distances, navigable waters for large steamers, major railways, canals, lighthouses, cables, docks, lightships, coaling stations, as well as the locations of British and American consular offices, dockyards, naval stations, and other significant points of interest (George, 1922).

This is a big improvement and change since before World War I the Azores Islands were not strategically utilized by other countries until it was deemed necessary during warfare. Prior to 1914, sailing routes and steamship routes did not traverse or incorporate the Azores Islands, as illustrated in Figure 5 depicting sailing and steamship routes from 1890, a period 24 years preceding the onset of World War I. The technological advancements in the Azores during World War I significantly improved navigational accuracy, safety, and situational awareness. These advancements not only benefited military operations but also had a lasting impact on civilian maritime activities in the region.

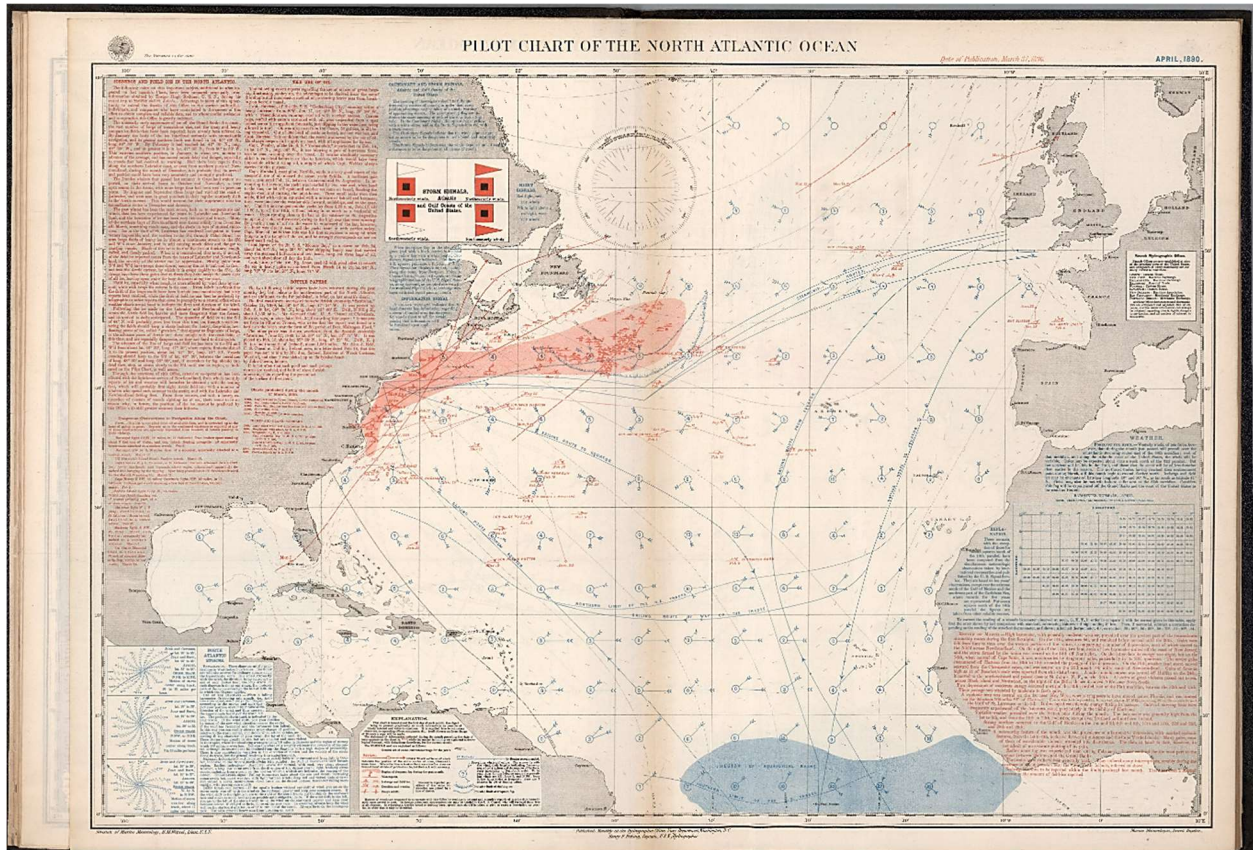


Figure 5. A maritime map depicting the North Atlantic Ocean in April 1890 is presented. The chart illustrates cities, shoals, coastlines, depths, sailing routes, islands, ocean currents, storm tracks, fog belts, weather forecasts, equatorial rains, wind force and directions. Additionally, it delineates icebergs, ice fields, and the extent of ice coverage (Witzel, 1890).

Strategic Significance of the Azores Islands during World War II

The Azores Islands retained strategic importance during World War II for several reasons, influencing the decisions and actions of Allied and Axis powers. The Azores served as bases for naval and air operations, so controlling these islands provided a strategic foothold in the Atlantic that enabled naval forces to project power and control shipping routes. The Azores offered a central location for communication and surveillance in the Atlantic. Possession of the islands allowed for monitoring and control of maritime and aerial activities, enhancing situational awareness.

Initially neutral, Portugal, under António de Oliveira Salazar's leadership, grew concerned about potential Axis invasion during World War II (Rodrigues, 2008). As the Allies gained momentum, Salazar shifted allegiance in 1943, realizing that aligning with the victorious Allies such as Britain and America, particularly those controlling the Atlantic, was crucial for the survival of Portugal's authoritarian regime and its colonial empire in a post-war democratic world order (Rodrigues, 2008). The islands became a diplomatic and geopolitical asset for Portugal, providing leverage and bargaining power in international relations.

In 1943, the Allied Chiefs of Staff evaluated that having Allied facilities in the Azores had the potential to save around 51.5 million gallons of aviation fuel between November 1943 and April 1944 (Rodrigues, 2008). Due to the Portuguese central government's restriction on the Azores as a trading hub, the islands served mainly as stopovers for trading vessels. As steamships replaced sailing vessels, traffic to the Azores significantly declined in the late 19th and early 20th centuries. Despite a decrease in the percentage of stopovers, the overall volume of people and goods crossing the Atlantic increased, aligning with the early trends of globalization (Littleton, 2022). The presence of German U-boats and the threat of submarine warfare in the Atlantic heightened the strategic importance of the Azores. Allied forces sought to establish control over the region to protect shipping lanes and counter German submarine operations.

Additionally, the Azores served as a critical waypoint for transatlantic air routes. Aircraft flying between North America and Europe used the islands for refueling and maintenance, making them essential for long-range air operations. The Azores served as a base for search and rescue operations in the Atlantic (Herz, 2014). The islands played a role in supporting and coordinating efforts to rescue downed pilots and sailors, thereby enhancing the safety of Allied personnel. Accurate navigation was vital for responding swiftly to incidents and conducting effective search and rescue missions.

Furthermore, the Azores were also strategically positioned to provide a defensive shield for the eastern approaches to the United States and Allied territories in the Americas. Controlling the individual islands allowed for better defense against potential Axis threats in the Atlantic.

Terceira, as featured in Figure 6, was a key island during World War II due to its airfield, Lajes Field. The United States and Great Britain established an airbase on Terceira, known as Lajes Air Base, which played a critical role in transatlantic air traffic and anti-submarine warfare (Kochis, 2020). The airbase served as a refueling and maintenance stop for aircraft flying between North America and Europe.

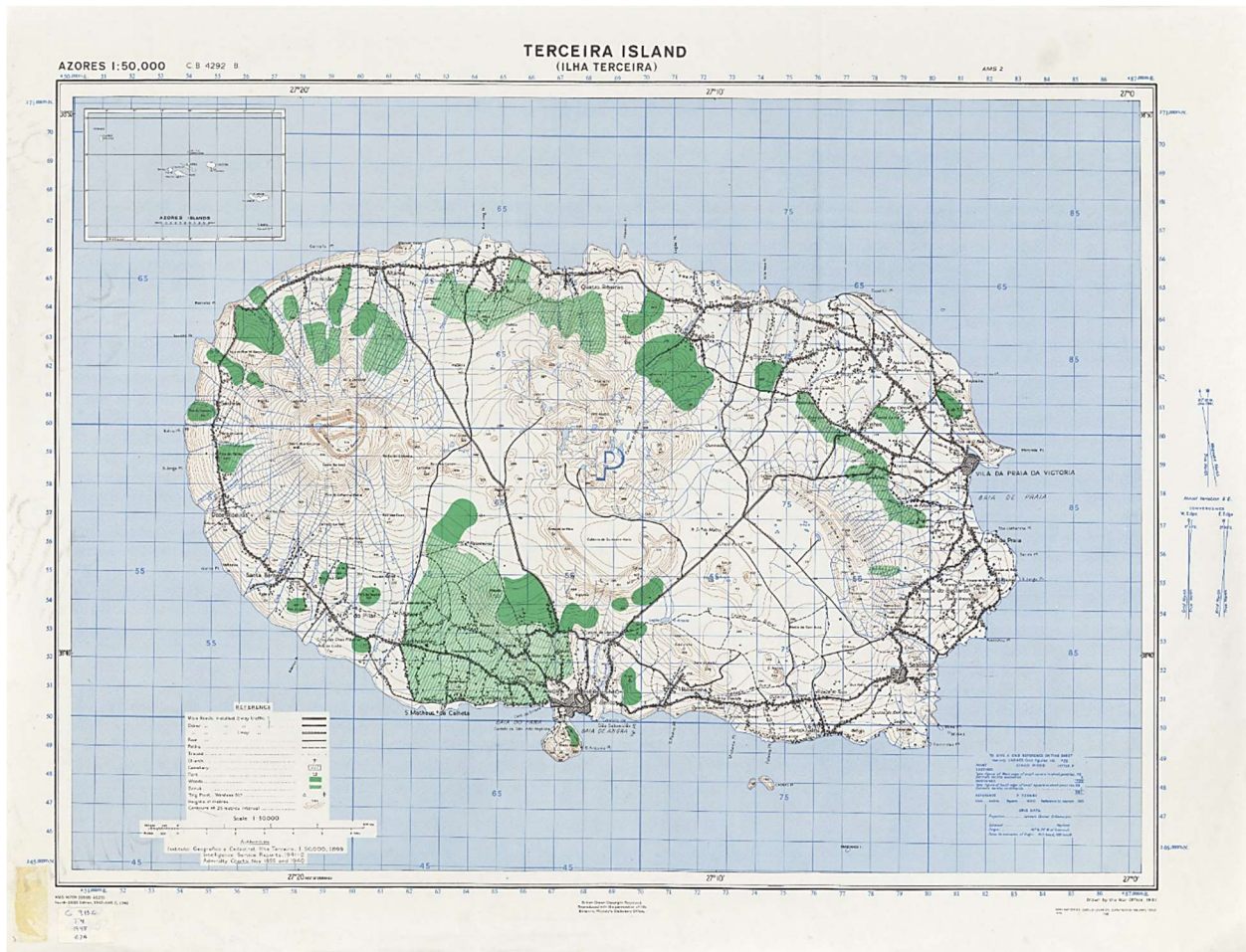


Figure 6. U.S. Army topographic map featuring Terceira Island with bearings and topographical information, along with an inset map featuring the Azores Islands. The map depicts the presence of roads and buildings (War Office, 1948).

São Miguel, the largest island in the Azores, also held great military significance. It hosted an airfield and served as a base for both Portuguese and Allied military operations. The island's strategic geographical position, as illustrated in Figure 7, made it important for surveillance and defense purposes. The initial airstrip was established on São Miguel Island, where the Portuguese forces established Air Base nr. 4 in 1941 (Monteiro, 2022). Following the establishment of the first airfield on Terceira Island, this airfield on São Miguel facilitated the first interisland land-to-land flight (Monteiro, 2022).

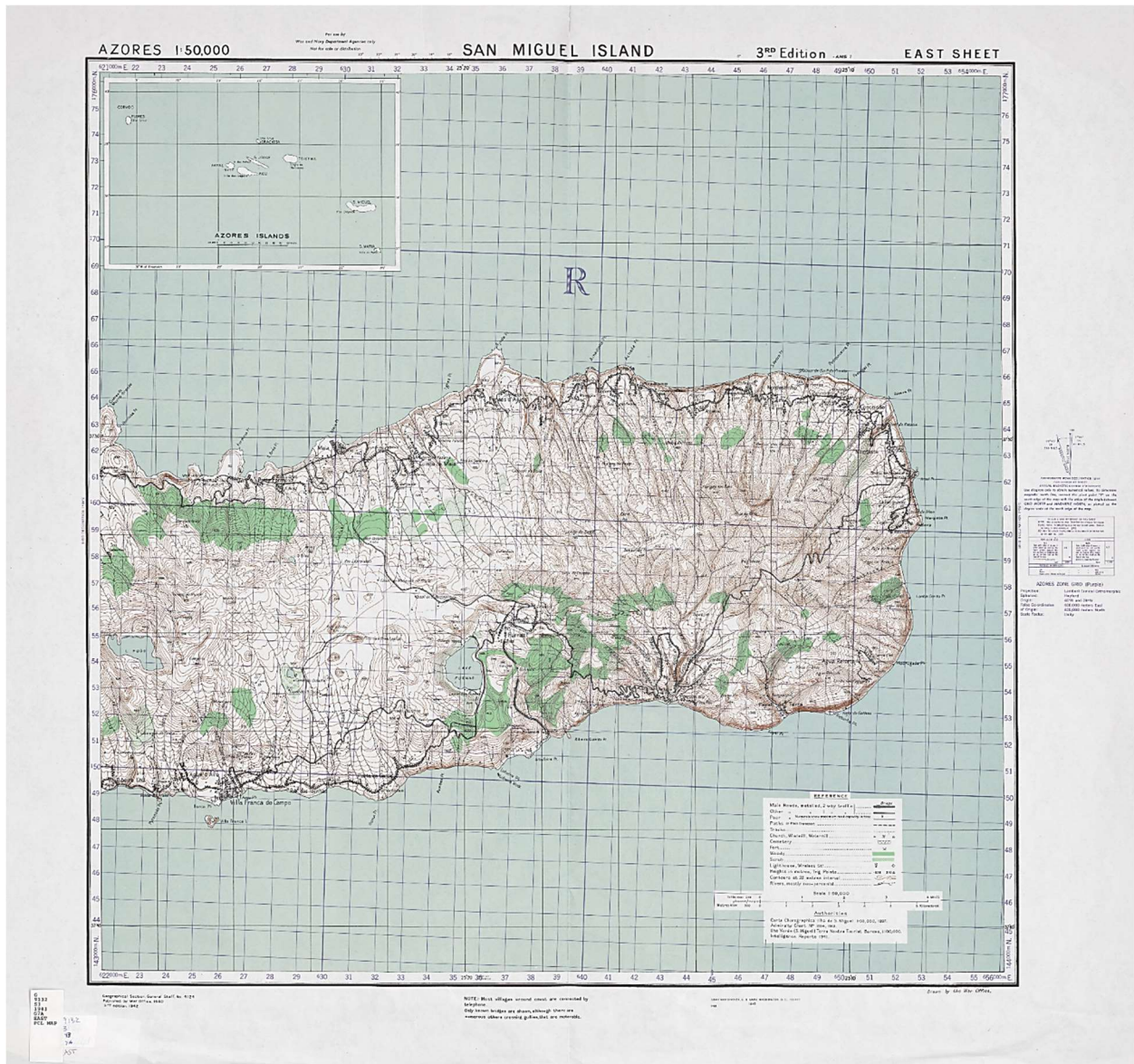


Figure 7. U.S. Army topographic map depicting São Miguel Island with bearings and topographical information, including roads, buildings, and lighthouses. Additionally, an inset map of the Azores Islands is provided for reference with relation to the main area map (War Office, 1943).

Santa Maria, the southernmost island depicted in Figure 8, housed an airfield that became part of the overall air defense network in the Azores. The airfield on Santa Maria played a role in anti-submarine operations and contributed to the overall security of the region (Smith, 1998). Furthermore, Santa Maria's flat terrain and favorable weather conditions made it well-suited for constructing and operating airfields (Herz, 2014).

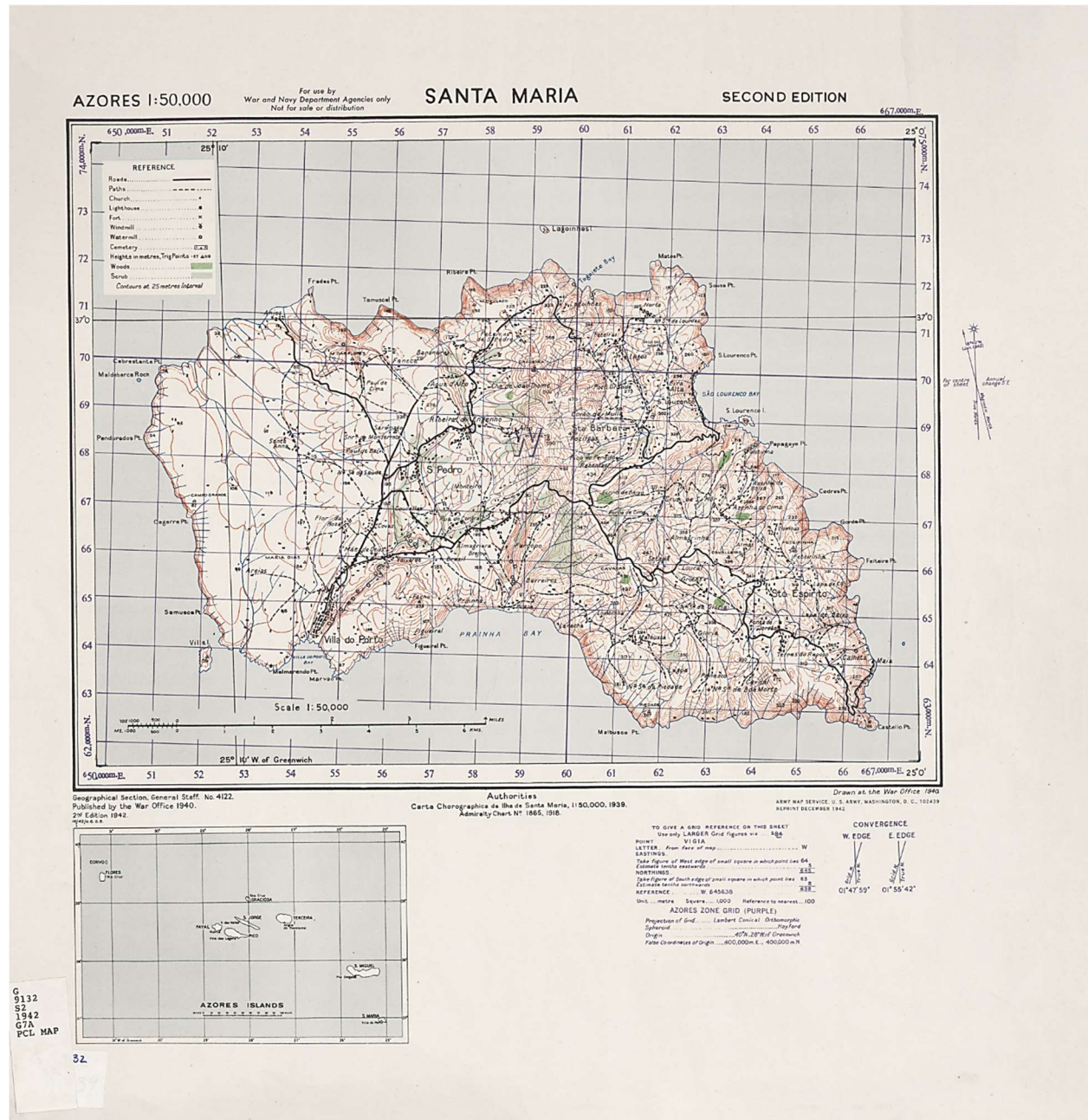


Figure 8. U.S. Army topographic map illustrating Santa Maria Island with bearings and topographical information showcasing buildings, roads, and lighthouses. An inset map of the Azores Islands is also included for reference (War Office, 1942).

Lastly, during World War II, Flores held strategic significance due to its location in the Atlantic Ocean. As one of the westernmost islands in the archipelago, as depicted in Figure 9, Flores served as a vital outpost for monitoring and controlling maritime traffic in the region. Its strategic position allowed for surveillance of shipping routes and provided early detection of enemy naval activity (Herz, 2014). Despite having a smaller-scale airfield compared to Santa Maria, Flores still contributed to supporting transatlantic air traffic between Europe and North America, serving as an emergency landing site and refueling point for aircrafts traversing the Atlantic (Herz, 2014).

Navigation Techniques utilized during World War II in the Azores

Advancements in navigation techniques during World War II played a multifaceted role in military operations in the Azores. From precision bombing to improved reconnaissance and anti-submarine warfare, these innovations significantly influenced strategic planning and the execution of military campaigns in the Atlantic theater. Enhanced navigation techniques, including radio navigation aids and improved maps, contributed to more precise aerial navigation (Craven, 1948). This increased accuracy was essential for strategic bombing campaigns and targeted military operations.

In terms of aerial reconnaissance, advances in aerial navigation allowed for more effective reconnaissance missions. Military aircraft could now navigate with greater precision, providing accurate intelligence on enemy positions, naval activities, and potential threats in the Azores (Rezendes, 2021). Additionally, submarine operations relied on advancements in underwater navigation techniques. Improved sonar systems and navigational instruments allowed submarines to navigate more accurately and engage in covert operations in the waters surrounding the Azores (Manstan, 2018).

The changing nature of warfare during World War II, marked by the expanded use of aircraft and submarines, had a profound impact on navigational routes and strategies in the Azores. The strategic significance of the Azores in the Atlantic Ocean led to the adaptation of navigational approaches to accommodate the evolving nature of conflict in the region. The increased use of aircraft, especially long-range bombers and patrol planes, influenced the establishment of transatlantic air routes (Herz, 2014).

The Azores, strategically located in the middle of the Atlantic, became crucial as a refueling and maintenance stop for aircraft flying between North America and Europe. Navigational strategies focused on optimizing these air routes to ensure efficient and safe transits. The construction of air bases on various Azores islands, such as Terceira and São Miguel (Kochis, 2020; Monteiro, 2022), became essential for supporting air operations.

Navigational strategies were designed to facilitate easy access to these bases, ensuring effective deployment and maintenance of aircraft. The expanded use of submarines, particularly German U-boats, in the Atlantic heightened the importance of anti-submarine warfare strategies in the Azores (Lardas, 2021). Navigational routes during the war were adjusted to prioritize areas where anti-submarine warfare patrols and defenses were most effective in countering submarine threats. Moreover, advances in meteorological technology were applied to enhance weather forecasting, which influenced navigation. Accurate weather predictions were crucial for planning and executing military operations around the Azores. In summary, the precise application of navigation skills and technologies contributed to the strategic significance of the Azores in the Atlantic theater.

Conclusion

In conclusion, the Azores Islands emerged as a pivotal theater during the turbulent periods of World War I and World War II, transcending their idyllic landscapes to assume a crucial strategic role in global conflicts. The strategic importance of the Azores during World War I was underscored by their geographic positioning in the North Atlantic. Serving as a vital midway point between North America and Europe, the Azores played a key role in naval operations and communication lines.

World War I navigation techniques included celestial navigation, dead reckoning, and the emerging use of radio signals. Between the wars, the Azores witnessed technological advancements, with improvements in airport infrastructure, telecommunications, and harbor facilities. World War II brought forth a renewed strategic importance for the Azores, influencing decisions and actions of both Allied and Axis powers. The islands served as potential bases for naval and air operations, communication hubs, and surveillance points. Terceira, São Miguel, and Santa Maria emerged as key islands during World War II, hosting airbases crucial for transatlantic air traffic, anti-submarine warfare, and overall defense.

The adaptation of navigational approaches ensured efficient air routes and optimized access to strategically located air bases on various Azorean islands. The heightened threat of submarines demanded adjustments in navigational routes, emphasizing areas where anti-submarine patrols were most effective. This investigation into the advancement of navigation techniques and navigational routes in the Azores during these wars revealed a dynamic interplay between technological progress, the changing nature of warfare, and the geopolitical significance of these islands.

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