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Science and Technology (Ottoman Empire/Middle East)

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Successfully deploying advances in technology and science was crucial to gaining a winning edge in World War I. Over the course of the war, the Ottoman military, often assisted by their German allies, invested substantial resources in increasing the empire's technological capacities. The army made considerable headway in expanding infrastructure and building an air force – projects involving feats of engineering they often documented and circulated using the latest technology in photography and film. Nonetheless, some major projects, such as the railway, remained incomplete until the war's end, undermining the army's capacity to fully exploit such technological achievements.

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Introduction

When the [Ottoman Empire](#) entered the war, much of its technological and scientific infrastructure was in various stages of construction or repair. The empire had a number of railroads, but strategic lines were incomplete; a fledgling [air school](#) needed a surge of resources to produce a nascent Ottoman air force; and key roads required improvements to make them more accessible for vehicular traffic. The war would spur a burst of activity to make each of these elements an effective component of the Ottoman war effort. The empire's well-developed telegraph system was a crucial conduit for the requisite [communication](#), but would be pushed to the limit by the war's demands. [Photography](#) and [film](#), meanwhile, provided tools for [propaganda](#) and documentation of the empire's technological accomplishments.

Railroads

Railroads were essential to the efficient deployment of troops and supplies. However, when the war started, work on key connections and extensions to the existing rail network was in the preliminary phases. Despite ongoing efforts over the course of the war to complete these gaps and extend the railroad further in strategic directions, the state of the railroad network posed a challenge to the effective mobilization of troops and transport of materials.

At the start of the war, the empire had hundreds of engines and passenger carriages as well as thousands of freight cars traversing 5,759 kilometers of rails built by various companies.^[1] Many of these lines had been constructed, at least in part, to serve foreign commercial or political interests. French-run lines in the eastern Mediterranean aimed to facilitate the transfer of hinterland goods to Mediterranean ports while the Baghdad railroad, stretching west to east across the empire, served geo-strategic goals for [Germany](#).^[2] The Ottoman-sponsored Hijaz railroad, an offshoot of the Baghdad railroad designed for both troop deployment and the pilgrimage to Mecca, extended south through the eastern Mediterranean and along the western side of the Arabian Peninsula.^[3]

Several factors affected these railroads' military usefulness: key frontier regions lacked rails, not all lines were well-positioned for troop deployment, and there were a number of gaps and gauge changes that interrupted or slowed operations.^[4] The eastern end of the railroad stopped a thirty-five-day march away from Erzurum, the region's primary fortress.^[5] Extending the rail further would have required the approval of [Russia](#), which had not been forthcoming.^[6] When the second army deployed in the summer of 1916 to provide reinforcements for the battered third army on the [Eastern Front](#), lack of rail slowed their arrival.^[7] In the south, the start of the war stalled negotiations to extend the Hijaz railroad to Mecca.^[8] Some of the rails, particularly the French-built ones in the eastern Mediterranean, used a narrow gauge, while others, like the Baghdad railroad, used a standard gauge, meaning that supplies had to be transferred where the gauge changed.^[9] The Baghdad railroad also had to pass through two mountain ranges along the route from Istanbul to Aleppo: the Taurus and the Amanus.^[10] The technical feats necessary to build these passages were daunting. The Taurus

section would require approximately thirty-six tunnels, some of which would be multiple kilometers long, while the Amanus range contained a mountain of quartz that had to be drilled through.^[11] The quartz was so hard it could make short work of 2,000 drill bits per day.^[12] Despite non-stop efforts over the course of the war to extend the line through this terrain, overcoming these geographical challenges would plague the Ottomans and their German allies until the war's end. Throughout the war, transporting supplies such as [artillery](#) shells from Germany or [Austria](#) to fronts in the east required numerous transfers. In Istanbul, after being taken across the Bosphorus on boats, the supplies were loaded on a train at the Haydarpasha station, then had to be unloaded at the Taurus mountains, where they were brought across on camels or trucks (and eventually a narrow-gauge rail through the Belededik provisional tunnel).^[13] They were then reloaded for another standard-gauge rail journey to the Amanus mountains, where they were again unloaded to be carried by camels (or, by early 1917, a narrow-gauge rail through the finally completed tunnels). After the Amanus range, they were transferred to a standard-gauge train for transport to Rियाق where they were once more unloaded and reloaded onto narrow gauge for destinations further south.^[14]

Following the Ottoman entry into the war, the French lines were taken over and all railroads eventually came under the authority of the War Ministry, including the Hijaz in 1916.^[15] The army prioritized completing existing lines and extending others towards strategic fronts. In the fall of 1914, a new line was built to link the former French railroad with the Hijaz line so trains could travel from Rियाق to Medina without stopping.^[16] While the Ottoman General Staff wanted to prioritize extending the railroad eastwards, given the Russian position, they and their German allies focused on completing the Baghdad railroad and expanding rails on the Hijaz line.^[17] To finish the Baghdad line, the thirty-eight-kilometer gap in the Taurus and the 100-kilometer gap in the Amanus needed to be closed, a bridge over the Euphrates had to be finished, and the line completed from Aleppo to Baghdad.^[18] Along the Hijaz line, work began on a link to [Egypt](#) in the hopes of eventually taking the Suez Canal.^[19]

Procuring the materials necessary for construction and maintaining an adequate workforce proved difficult. Supply routes by [sea](#) were inaccessible due to the Allied [blockade](#) in the Mediterranean and the Russian presence in the Black Sea, so most supplies had to come by rail or road after being funneled through Istanbul.^[20] Essential materials like drill bits were shipped from Germany and could spend five months in transit.^[21] Oil and spare parts were difficult to come by.^[22] With materials in short supply, tracks deemed less strategic, such as the narrow-gauge rails from the Haifa-Acre and Damascus-Muzayrib lines, were dismantled and incorporated into the building of more strategic lines, like the Hijaz-Egypt line, which eventually reached Beersheba.^[23] By the summer of 1916, as the war settled into a more protracted fight, priorities shifted to producing more materials locally.^[24] Fluctuations in [labor](#) power also made it difficult to maintain construction at a consistent pace. Mobilization caused the Baghdad railroad's workforce to fall from 11,796 to 1,651 between August and September 1914.^[25] Then, during the summer of 1915, Baghdad railroad engineers were

reassigned to work on the Hijaz-Egypt rail link.^[26] Despite these setbacks, by January 1916, the Baghdad railroad had a substantial workforce of over 13,000.^[27] Many of those involved in the construction were organized into conscripted labor battalions comprised of Ottoman subjects, usually from Greek, Armenian, and Bulgarian communities, who were sent to these battalions in lieu of fighting.^[28] In June 1916, construction in the Amanus faced a major blow due to the [deportation](#) of 4,200 Armenian laborers by Ottoman soldiers. This precipitated the desertion of another 1,200 Ottoman laborers who were replaced with British [prisoners of war](#) from the Ottoman victory at [Kut al-Amara](#).^[29]

Fueling the railroads posed another challenge. The Allied blockade impeded coal shipments, including from the empire's own Ereğli coal fields on the Black Sea, to which the Russian navy also hampered access.^[30] Coal needed to be imported from Germany.^[31] The eastern Mediterranean was in dire straits as a result. An attempt to extract and use coal from Mount Lebanon proved unsuccessful as it contained too much sulfur, which damaged the train engines, and did not produce sufficient energy when burned.^[32] Using wood was an imperfect solution, as 150,000 tons were needed annually.^[33] Wood also took up more space and needed to be replenished often – a seventeen-hour trip from Damascus to Aleppo became three to four days during the war.^[34] Rails were built directly into forests to collect wood.^[35] Trees and bushes (including olive trees) were cut down and, towards the end of the war, even tree roots were dug up for fuel.^[36] Only in late 1918, once a rail line was finally opened through the Taurus and Amanus, could Germany send 100 wagons of coal.^[37]

Despite these difficulties, the railroads were essential, if at times inefficient, conduits for supplies and troops. Once the Suez Canal closed, for instance, the Hijaz railroad was the main route for dispatching soldiers and food from Damascus to points further south.^[38] While the war saw a number of breakthroughs in railroad construction, some routes remained unfinished. The Egypt extension would never make it to the Suez Canal – it would only reach as far as the eastern side of the Sinai Peninsula and then have to be abandoned after the British counterattacked.^[39] In the east, work extending the line from Çerekli to Sivas was still incomplete at the war's end.^[40] On the other hand, improved gauge between Ramla and Jerusalem allowed for uninterrupted communication between Damascus and Jerusalem.^[41] The Baghdad line saw a 1.8 km tunnel constructed through the Taurus at Belededik by January 1915, the opening of a steel bridge across the Euphrates in April 1915, the successful boring of the Bahçe tunnel in the Amanus and sixty-two kilometers constructed to the east of Tell Abyad in June 1915, and finally, by January 1917, the completion of the Amanus tunnel.^[42] From January to June 1917 the materials carried by the Baghdad railroad increased from zero tons to 72,000.^[43] Despite these accomplishments, the Yildirim Campaign, which started in the fall of 1917, was hamstrung by a railroad that remained clunky to navigate – the narrow gauge in the Belededik and Bahçe tunnels required unloading and reloading and, once supplies reached the

Euphrates near Jarabulus, they had to either be taken down the river or carried through the desert for destinations further east.^[44] The Taurus tunnels were not completed until September 1918.^[45]

Roads and Infrastructure

Another priority for the Ottoman army was the construction of new roads and the repair of old ones. While there had been a flurry of road building in the western regions of the empire as it entered the war, roads in the eastern provinces were in worse shape.^[46] Many were unpaved.^[47] Roads connecting the gaps in the railroad – a major east-west [transportation](#) route – also needed upgrading. In part, this state of affairs was due to the fact that much of Ottoman transport had been seaborne.^[48] However, with the Allied blockade making the Aegean and the Mediterranean inaccessible from the early days of the war and Russian battleships patrolling the Black Sea by the summer of 1915, improving and expanding the empire's road network became an urgent matter.^[49]

In the eastern Mediterranean, the roads between Pozantı and Tarsus as well as Osmaniye and Qatma needed critical upgrading. The latter, according to one assessment, was not even passable with horse carts much less motor cars.^[50] Cemal Paşa (1872-1922) observed their state firsthand as he traveled to take up the post of military governor in the eastern Mediterranean. Anxious to begin improvements, he proposed constructing a road south from Pozantı, but had to settle for only overseeing repairs within his jurisdiction. In the north, the task fell to the governor of Aleppo, who orchestrated upgrades between Islahiye and Qatma and between Alexandretta and Aleppo.^[51] Eight months later, motor cars could finally travel from Pozantı to Aleppo, although trucks without rubber tires, which were more common in the Ottoman army, still struggled and often broke down.^[52] Further south, Cemal Paşa worked on building macadamized roads from Damascus to Nablus and from Amman to Jericho, which meant Damascus and Amman were now linked to roads in Nablus and Jericho respectively that led to Jerusalem. By the end of 1915, these routes were also accessible for motorized forms of transport.^[53] The road between Hebron and Beersheba also saw repairs, and, after the unsuccessful Suez Campaign, Cemal Paşa turned his attention to constructing a road from Riyaq across the Beqaa Valley and down the Jordan Valley as well as another from Daraa to Ajlun to the Jordan Valley. Both projects were ongoing when he departed.^[54]

Labor battalions were critical to road construction and repair. As of October 1914, they were organized and distributed across all the military jurisdictions. Their work focused on key routes to stockpiles of [food](#) and supplies. One route crossed central Anatolia from Ulukışla to Erzurum. It ran through Niğde, Kayseri, Sivas, and Zara with a branch line from Zara to Gümüşhane and the Black Sea port city of Trabzon. In the west, key routes extended from Adapazarı to Akçaşehir and Bandırma to Biga close to Çanakkale.^[55] Animals were frequently used for transportation and the army requisitioned (or bought, in the case of camels acquired from the Bedouin) numerous horses, mules, donkeys, camels, and oxen over the course of the war.^[56]

Water-based transport in the seas surrounding the empire was virtually impossible during the war. The navigable Tigris and Euphrates rivers had well-organized routes for boats and river steamers, although their water levels were prone to seasonable variability.^[57] Paved roads connected the port of Trabzon to the interior, but this port fell into Russian hands in April 1916, following the same fate as the port of Rize in March 1916.^[58] The Russians also bombed the Black Sea port of Zonguldak, the main port used for exporting coal, and sank numerous vessels in the sea until the [Russian Revolution](#) led to their withdrawal.^[59] The Sea of Marmara was treacherous due to British and French submarines, which sank around fifty Ottoman steamships, although fewer submarines passed through the straits later in the war due to [mines](#).^[60]

Air Force

The Ottoman air force expanded rapidly during the war. It provided intelligence and shot down a number of Allied aircraft.^[61] The air force had its origins in the Yeşilköy Aviation School, which the government had established in 1912 to provide domestic opportunities for flight training after sending students abroad to study starting in 1911.^[62] The Department of the Supreme Military Command oversaw the school.^[63] When the Ottomans entered the war, they had six war [planes](#) and four training planes. They also requisitioned three additional planes that happened to be in Istanbul.^[64] Four planes stayed at the school, while eight were attached to specific units. Two were dispatched to the Eastern Front.^[65] The Ottomans had also ordered and paid for fifteen French *Nieuport* planes that had not yet been delivered and were seized by the French when the war broke out.^[66] The Germans stepped up to supply personnel and planes.

In February 1915, First Lieutenant [Erich Serno \(1886-1963\)](#) was appointed to the task of managing the Ottoman air force. In addition, twelve German aviators were dispatched to different Ottoman squadrons.^[67] Squadrons received commands from the army in the region to which they were dispatched.^[68] They tended to be composed of a combination of Ottoman and German personnel since, at least in the first year of the war, the Ottomans only had thirteen pilots and eleven observers. Twenty-three students were in training at the Yeşilköy school.^[69] Pilots flew early sorties on the southern and eastern fronts, and [reconnaissance](#) flights over British bases in the Aegean provided intelligence on the [Gallipoli Campaign](#).^[70] By the end of 1915, the empire had seven squadrons and two different branches were created within the government to deal with aviation affairs.^[71] As of 1916, the air force had expanded significantly and could now count among its personnel eighty-one observers and pilots as well as approximately ninety airplanes that were divided between twelve squadrons. In 1917, it received another 108 German aircraft and, in 1918, seventy-nine.^[72]

As the air force grew, its operations included flying over mountainous terrain in the third army region and, by 1917, action on British-held fronts in Palestine and [Mesopotamia](#) as well as in Gallipoli

against potential British maneuvers. During the summer of 1917, however, the British were anxious to prevent the Ottomans from gaining insight into General [Edmund Allenby's \(1861-1936\)](#) plans in Palestine and Ottoman air force pilots struggled to carry out reconnaissance. As a result, [Liman von Sanders \(1855-1929\)](#) could not assess the deception behind Allenby's movements in September 1918, nor could the Ottoman squadrons defend the army from aerial bombardment as they retreated.^[73]

Communication

Extending lines of communication and maintaining uninterrupted connections was essential for rapidly conveying information about developments on multiple fronts. When the war started, the Ottoman Empire had a substantial, comprehensive telegraph network of 66,410 kilometers (11,027 of which were connected to the railroads) that enabled even the most remote areas of the empire to communicate with the imperial center.^[74] In addition, the domestic manufacture of telegraph machines had increased substantially in the latter half of the 19th century – an Istanbul factory turned out more than 5,000 by 1918.^[75] However, while the network was extensive, the remotest parts of the empire had single lines, which could only carry a modest load.^[76] In Syria, extending the line was another of Cemal Paşa's priorities.^[77] The telegraph was a crucial tool for conveying orders and sending responses. Provincial officials also used it to alert Istanbul to local issues that were of critical importance to strategic planning.^[78] Communications were surveilled and secured. Important telegrams used a numerical code that had to be deciphered.^[79] In addition, most forms of communication were placed under military supervision and [censorship](#) was enforced.^[80] The lines were so overwhelmed with military communications that it was difficult to access them for civilian purposes.^[81]

The empire had no wireless system when the war began, although it started to establish one by the end.^[82] Still, the wireless would have a key role to play in negotiating the [Treaty of Mudros](#). Ottoman negotiators used it to communicate with Istanbul after a British ship was unable to lay a cable to Çeşme.^[83] Only Istanbul had telephone service and thus its use was restricted to the Dardanelles front.^[84] The military had to rely primarily on the telegraph for most of its important communications.

Photography/Film

[Photography](#) and the new [technology](#) of [film](#) served as vehicles for government propaganda and provided glimpses of life on the front lines. In 1915, the Ottoman army established the Central Army Cinema Office to create propaganda films, newsreels, and feature films.^[85] [Fuat Uzkınay \(1888-1956\)](#), a reserve officer who replaced the Office's original Romanian director in 1916, worked with both Austrian and German filmmakers to improve his technique and help the Office increase its

offerings.^[86] The *Müdafaa-i Milliye Cemiyet* (National Defense League) also produced propaganda, including *actualité* films and a series of *Harb-i Umûmî Panoraması* (*Great War Panorama*) photo collections.^[87]

Photography facilitated the distribution of vivid images from the front. The magazine *Harb Mecmuası* (*War Journal*), published by the General Staff Headquarters Intelligence Office, was full of such propagandistic images.^[88] Not only did they capture the action of battle, soldiers' daily lives, or local monuments of interest, they also served to demonstrate the Ottoman army's technological prowess.^[89] Images highlighted the railway and its workers constructing tracks through the desert or assembling bridges. They featured tunnels and air force planes.^[90] A number of Ottoman war photographers took photographs as part of their military service.^[91] Arif Hikmet Koyunoğlu (1888-1982) served with an Ottoman ski team on the Eastern Front and captured shots of the unit near Erzurum.^[92] During the Gallipoli Campaign, Burhan Felek (1889-1982), who had been made the army headquarters' official photographer in 1914, took shots from within the trenches and behind the lines. He recalled that producing photographs could be time-consuming – he could only take twelve photos a day with his hefty reflex 10x15cm camera.^[93]

Conclusion

The more integrated technical and scientific infrastructure and better lines of communication constructed during the war could be drawn upon during the War of Independence and, under the Turkish Republic, the government would continue to expand and build upon them. However, the division of the empire's eastern Mediterranean provinces between French and British mandate rule at the end of the war would be an obstacle to the comprehensive exploitation of these resources in that region.

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Notes

1. ↑ Yalman, Ahmed Emin: *Turkey in the World War*, New Haven 1930, p. 86; Zürcher, Erik J.: *The Young Turk Legacy and Nation Building. From the Ottoman Empire to Atatürk's Turkey*, London 2010, p. 66.

2. ↑ Owen, Roger: *The Middle East in the World Economy*, London 2009, p. 246; Zürcher, Young 2010, p. 66; McMeekin, Sean: *The Berlin-Baghdad Express. The Ottoman Empire and Germany's Bid for World Power*, Cambridge 2010, pp. 36, 37-40.
3. ↑ See Özyüksel, Murat: *The Hejaz Railway and the Ottoman Empire. Modernity, Industrialisation and Ottoman Decline*, London 2014, pp. 41-95.
4. ↑ Erickson, Edward J.: *Ordered to Die. A History of the Ottoman Army in the First World War*, Westport 2001, p. 17.
5. ↑ Zürcher, Young 2010, p. 183.
6. ↑ Yalman, Turkey 1930, p. 85.
7. ↑ Erickson, *Ordered* 2001, p. 138.
8. ↑ Özyüksel, *Hejaz* 2014, p. 170-172.
9. ↑ Yalman, Turkey 1930, p. 86; Zürcher, Young 2010, pp. 182-183.
10. ↑ See McMurray, Jonathan S.: *Distant Ties. Germany, the Ottoman Empire, and the Construction of the Baghdad Railroad*, Westport 2001, p. 115, McMeekin, *Baghdad* 2010, p. 240.
11. ↑ McMeekin, *Baghdad* 2010, pp. 44, 238.
12. ↑ *Ibid.*, p. 238.
13. ↑ Zürcher, Young 2010, p. 182; McMurray, *Distant* 2001, p. 127.
14. ↑ Zürcher, Young 2010, pp. 182-183.
15. ↑ Özyüksel, *Hejaz* 2014, p. 192.
16. ↑ *Ibid.*
17. ↑ Yalman, Turkey 1930, p. 85; McMurray, *Distant* 2001, p. 115; Özyüksel, *Hejaz* 2014, p. 193.
18. ↑ McMurray, *Distant* 2001, p. 115; Özyüksel, *Hejaz* 2014, p. 26. The Taurus pass could take four days to march across (Erickson, *Ordered* 2001, p. 130). The completed railroad was expected to cut travel between Istanbul and Mecca to approximately six days (Özyüksel, *Hejaz* 2014, p. 62).
19. ↑ McMurray, *Distant* 2001, p. 119.
20. ↑ Yalman, Turkey 1930, p. 89; Zürcher, Young 2010, p. 183; McMurray, *Distant* 2001, p. 116.
21. ↑ McMeekin, *Baghdad* 2010, p. 238; McMurray, *Distant* 2001, p. 118.
22. ↑ Özyüksel, *Hejaz* 2014, pp. 196-197.
23. ↑ *Ibid.*, p. 194; Kayalı, Hasan: *Wartime Regional and Imperial Integration of Greater Syria during World War I*, in: Philipp, Thomas / Schaebler, Birgit (eds.): *The Syrian Land. Processes of Integration and Fragmentation*, Stuttgart 1998, p. 299.
24. ↑ McMurray, *Distant* 2001, p. 123.
25. ↑ *Ibid.*, p. 115.
26. ↑ *Ibid.*, p. 119.
27. ↑ *Ibid.*, p. 120.
28. ↑ Shaw, Stanford J.: *The Ottoman Empire in World War I. Prelude to War*, volume 1, Ankara 2006, pp. 342, 344.
29. ↑ McMurray, *Distant* 2001, pp. 121, 122; Zürcher, Young 2010, p. 182; Rogan, Eugene: *The Fall of the Ottomans. The Great War in the Middle East*, New York 2015, p. 272.

30. † Özyüksel, Hejaz 2014, p. 195; Yalman, Turkey 1930, p. 86.
31. † Yalman, Turkey 1930, p. 87.
32. † Özyüksel, Hejaz 2014, p. 195. Özyüksel also relates an anecdote in which Hungarian engineers, brought in to help with the railroad, even demonstrated how Lebanese coal could be processed in such a way to make it suitable, but rivalry between the Austro-Hungarians and Germans working on the line led to a spat that went all the way to Istanbul and apparently prevented any further follow-through with the coal (p. 196).
33. † Ibid., p. 195.
34. † Zürcher, Young 2010, p. 183.
35. † Özyüksel, Hejaz 2014, p. 195; McMurray, Distant 2001, p. 123.
36. † Ochsenswald, William: The Hijaz Railroad, Charlottesville 1980, p. 144; McMurray, Distant 2001, p. 127; Kayalı, Wartime 1998, p. 300; Özyüksel, Hejaz 2014, p. 195.
37. † Özyüksel, Hejaz 2014, p. 195; McMeekin, Baghdad 2010, p. 341; Zürcher, Young 2010, p. 182.
38. † Özyüksel, Hejaz 2014, p. 192.
39. † Ibid., p. 195.
40. † Zürcher, Young 2010, p. 183; Ginio, Eyal: Landscapes of Modernity and Order. War and Propaganda in Ottoman Writing during World War I, in: Yavuz, M. Hakan / Ahmed, Feroz (eds.): War and Collapse. World War I and the Ottoman State, Salt Lake City 2016, p. 282. The railroad would in fact not be completed until the 1930s (Ginio, Landscapes 2016, p. 293).
41. † Kayalı, Wartime 1998, p. 299.
42. † McMeekin, Baghdad 2010, p. 241; McMurray, Distant 2001, p. 118; Yalman, Turkey 1930, p. 85.
43. † McMurray, Distant 2001, p. 125.
44. † Ibid., p. 127.
45. † Zürcher, Young 2010, p. 182.
46. † Yalman, Turkey 1930, p. 88.
47. † Erickson, Ordered 2001, p. 19.
48. † Yalman, Turkey 1930, p. 88.
49. † Ibid., p. 89.
50. † Ibid., p. 88; Kayalı, Wartime 1998, p. 298.
51. † Kayalı, Wartime 1998, p. 298.
52. † Yalman, Turkey 1930, p. 88; Zürcher, Young 2010, p. 183.
53. † Kayalı, Wartime 1998, p. 298.
54. † Ibid., p. 299.
55. † Shaw, Ottoman 2006, p. 344.
56. † Yalman, Turkey 1930, pp. 88-89; Zürcher, Young 2010, pp. 183-184; Auswärtiges Amt, Berlin, Politisches Archiv (AA-PA), Türkei 177, Bd. 13, Dr. Ruppin to Abram I. Elkus, American ambassador, 13 October 1916.
57. † Erickson, Ordered 2001, p. 19.
58. † Ibid., p. 128.

59. ↑ Yalman, Turkey 1930, p. 89.
60. ↑ Ibid.
61. ↑ Erickson, Ordered 2001, p. 227-230.
62. ↑ Kline, Stuart: Türk Havacılık Kronolojisi = A Chronicle of Turkish Aviation, Istanbul 2002, pp. 11-12; Yalçın, Osman: Türk Hava Gücü. Kuruluş, ilk seferleri ve yükselişi (1911-1950) [Turkish air power. Its establishment, first journeys, and growth (1911-1950)], Istanbul 2017, pp. 27-28.
63. ↑ Erickson, Ordered 2001, p. 227.
64. ↑ Yalçın, Türk 2017, p. 111; Erickson, Ordered 2001, p. 227. Kline asserts that when the empire entered the war it had “five landplanes and two seaplanes” (Kline, Havacılık 2002, p. 97).
65. ↑ Erickson, Ordered 2001, p. 227.
66. ↑ Kline, Havacılık 2002, pp. 13, 97; Yalçın, Türk 2017, pp. 51-52.
67. ↑ Yalçın, Türk 2017, p. 112; Erickson, Ordered 2001, p. 228.
68. ↑ Erickson, Ordered 2001, p. 227.
69. ↑ Ibid., p. 228
70. ↑ Ibid.
71. ↑ Ibid.
72. ↑ Ibid., pp. 228-229.
73. ↑ Ibid., p. 230.
74. ↑ Yalman, Turkey 1930, p. 90; Bektaş, Yakup: Telegraph, in: Ágoston, Gábor / Masters, Bruce (eds.): Encyclopedia of the Ottoman Empire, New York 2009, p. 557. One estimate places the number of telegrams sent per year on the eve of the war at 5,500,000 (Davison, Roderic H.: Essays in Ottoman and Turkish History, 1774-1923. The Impact of the West, Austin 1990, p. 138).
75. ↑ Davison, Essays 1990, p. 144.
76. ↑ Yalman, Turkey 1930, p. 90.
77. ↑ Kayalı, Wartime 1998, p. 300.
78. ↑ See, for example, Çiçek, M. Talha: War and State Formation in Syria. Cemal Pasha's Governate during World War I, 1914-1917, London 2014.
79. ↑ See, for example, Başbakanlık Osmanlı Arşivi (BOA), Istanbul, DH.ŞFR 581/4.
80. ↑ Beşikçi, Mehmet: The Ottoman Mobilization of Manpower in the First World War. Between Voluntarism and Resistance, Boston 2012, p. 55.
81. ↑ Yalman, Turkey 1930, p. 90.
82. ↑ Ibid.
83. ↑ Zürcher, Young 2010, p. 190.
84. ↑ Yalman, Turkey 1930, p. 90.
85. ↑ Köroğlu, Erol: Ottoman Propaganda and Turkish Identity. Literature in Turkey during World War I, London 2007, p. 79; Arslan, Savaş: Cinema in Turkey. A New Critical History, Oxford 2011, p. 33.
86. ↑ Köroğlu, Propaganda 2007, pp. 79-80; Arslan, Cinema 2011, p. 33.

87. † Selvi, Haluk / Dagalı, Fatih (eds.): Harb-i Umûmî Panoraması [Great War Panorama], İstanbul 2015; Arslan, Cinema 2011, pp. 39-40; Köroğlu, Propaganda 2007, p. 80.
88. † Köroğlu, Propaganda 2007, p. 81.
89. † Ginio, Landscapes 2016, p. 286.
90. † Ginio, Landscapes 2016, pp. 286-287, 293.
91. † Özendes, Engin: Photography in the Ottoman Empire, 1839-1923, İstanbul 2013, pp. 315-319.
92. † Özendes, Photography 2013, p. 317.
93. † Ibid.

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