



2 Engineering and manufacturing past, present, and future

Criteria	Range	Resource identified
2.1 Sectors of the engineering industry	Aerospace	https://www.careersinaerospace.com/roles/engineering/aerospace-engineering/ https://en.wikipedia.org/wiki/Aerospace_engineering https://www.careerpilot.org.uk/job-sectors/engineering-design/job-profile/aerospace-engineer
	Agriculture	https://nationalcareers.service.gov.uk/job-profiles/agricultural-engineer https://www.myworldofwork.co.uk/my-career-options/job-profiles/agricultural-engineer https://en.wikipedia.org/wiki/Agricultural_engineering
	Automotive	https://targetjobs.co.uk/careers-advice/engineering/automotive-engineering-industry-sector-overview https://www.imeche.org/industry-sectors/automotive-engineering https://en.wikipedia.org/wiki/Automotive_engineering
	Building services	https://www.cibse.org/building-services/what-is-building-services https://en.wikipedia.org/wiki/Building_services_engineering https://targetjobs.co.uk/careers-advice/job-descriptions/building-services-engineer-job-description
	Chemical	https://www.aidche.org/k-12/what-do-chemical-engineers-do https://targetjobs.co.uk/careers-advice/engineering/chemical-engineering-industry-sector-overview https://en.wikipedia.org/wiki/Chemical_engineering
	Civil engineering	https://en.wikipedia.org/wiki/Civil_engineering https://nationalcareers.service.gov.uk/job-profiles/civil-engineer
	Defence	https://www.allaboutcareers.com/career-path/defence-engineering/ https://www.totaljobs.com/advice/defence-engineer-job-description
	Electrical and electronic	https://nationalcareers.service.gov.uk/job-profiles/electronics-engineer https://nationalcareers.service.gov.uk/job-profiles/electrical-engineer https://en.wikipedia.org/wiki/Electrical_engineering
	Healthcare	https://en.wikipedia.org/wiki/Healthcare_engineering https://www.healthcareers.nhs.uk/explore-roles/healthcare-science/roles-healthcare-science/physical-sciences-and-biomedical-engineering/medical-engineering https://www.prospects.ac.uk/job-profiles/biomedical-engineer



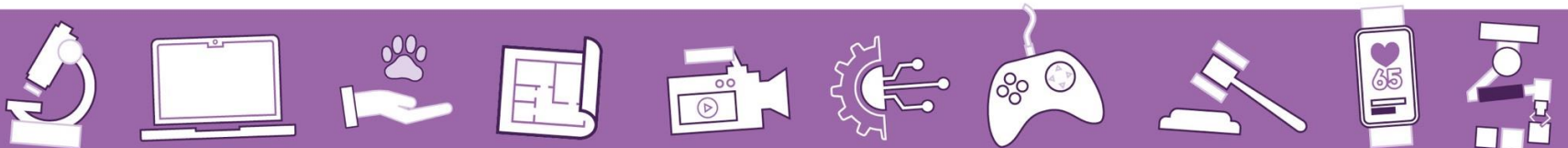


	Manufacturing	https://www.prospects.ac.uk/jobs-and-work-experience/job-sectors/engineering-and-manufacturing/overview-of-the-engineering-and-manufacturing-sector-in-the-uk https://en.wikipedia.org/wiki/Manufacturing_engineering https://www.getreskilled.com/what-is-a-manufacturing-engineer/
	Marine	https://www.maritimeuk.org/careers/explore-sector/marine-engineering/ https://targetjobs.co.uk/careers-advice/engineering/marine-engineering-industry-sector-overview https://nationalcareers.service.gov.uk/job-profiles/marine-engineer
	Petrochemical, power generation (renewables, non-renewables, nuclear)	https://en.wikipedia.org/wiki/Petroleum_engineering https://www.srgtalent.com/blog/jobs-available-in-petroleum-engineering https://www.youtube.com/watch?v=LurOPb6lboxl https://www.britannica.com/technology/petroleum-engineering/Branches-of-petroleum-engineering
	Telecommunications	https://nationalcareers.service.gov.uk/job-profiles/telecoms-engineer https://en.wikipedia.org/wiki/Telecommunications_engineering https://www.prospects.ac.uk/job-profiles/communications-engineer
	Waste management	https://www.gostudy.net/occupation/waste-management-engineer https://www.recycling-magazine.com/2020/09/07/waste-management-in-engineering/ https://www.nof.co.uk/news/2020/august/waste-management-in-engineering-repairing-recycling-and-innovating/
2.2 Significant technological advances in engineering from a historical perspective	Steam engine and railways	https://www.raildiscoveries.com/the-discovery-blog/2018/september/a-brief-history-of-the-railways/ https://www.networkrail.co.uk/who-we-are/our-history/eminant-engineers/ https://www.britannica.com/technology/railroad/Railroad-history http://www.trainhistory.net/railway-history/railroad-history/ https://www.historic-uk.com/HistoryUK/HistoryofBritain/Steam-trains-railways/
	Development of steelmaking	https://britishsteel.co.uk/who-we-are/where-weve-come-from/ https://www.bbc.co.uk/news/business-36337180 https://www.britannica.com/technology/steel/History





Electrical power and the light bulb	https://www.bulbs.com/learning/history.aspx https://www.energy.gov/articles/history-light-bulb https://www.fi.edu/history-resources/edisons-lightbulb https://eandt.theiet.org/content/articles/2018/09/the-story-of-the-light-bulb-from-early-days-to-leds/ https://www.nationalgrid.com/stories/energy-explained/history-of-energy https://nmgroup.com/en-gb/resources/news/history-of-uk-electricity-network
The internal combustion engine	https://www.motorbiscuit.com/the-interesting-history-of-the-internal-combustion-engine/ https://en.wikipedia.org/wiki/History_of_the_internal_combustion_engine https://www.hotcars.com/internal-combustion-engine-history/ https://www.britannica.com/technology/internal-combustion-engine
Replaceable parts and mass production	https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/development-mass-production-has-dramatic-impact-industry-and-society https://www.history.com/this-day-in-history/fords-assembly-line-starts-rolling https://www.ford.co.uk/experience-ford/history-and-heritage https://en.wikipedia.org/wiki/Mass_production
Television and radio	https://www.techwholesale.com/history-of-the-radio.html https://lynn-library.libguides.com/c.php?g=591810&p=4092057 https://www.youtube.com/watch?v=qgkepUUED7k https://www.bbc.com/historyofthebbc/100-voices/birth-of-tv https://www.britannica.com/technology/television-technology
Automated machines	https://www.britannica.com/technology/automation https://www.thinkautomation.com/bots-and-ai/a-history-of-automation-the-rise-of-robots-and-ai/ https://www.weforum.org/agenda/2020/09/short-history-jobs-automation/ https://www.britannica.com/technology/automation/Manufacturing-applications-of-automation-and-robotics





	Computer and internet	https://www.livescience.com/20718-computer-history.html https://www.computerhistory.org/timeline/computers/ https://www.webfx.com/blog/web-design/the-history-of-computers-in-a-nutshell/ https://www.britannica.com/technology/computer/Early-business-machines https://home.cern/science/computing/birth-web/short-history-web https://webfoundation.org/about/vision/history-of-the-web/
2.3 Areas of innovation and emerging trends in engineering	Artificial intelligence (AI)	https://www.thinkautomation.com/bots-and-ai/a-history-of-automation-the-rise-of-robots-and-ai/ https://www.ibm.com/uk-en/cloud/learn/what-is-artificial-intelligence https://www.youtube.com/watch?v=nASDYRkbQIY https://www.youtube.com/watch?v=SN2BZswEWUA
	Virtual reality (VR)	https://www.wired.com/story/wired-guide-to-virtual-reality/ https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html https://www.theguardian.com/technology/2016/nov/10/virtual-reality-guide-headsets-apps-games-vr
	Augmented reality (AR)	https://www.fi.edu/what-is-augmented-reality https://www.forbes.com/sites/bernardmarr/2018/07/30/9-powerful-real-world-applications-of-augmented-reality-ar-today/ https://www.apple.com/uk/augmented-reality/ https://arvr.google.com/ar/
	Robotics	https://builtin.com/robotics https://whatis.techtarget.com/definition/robotics https://www.britannica.com/technology/robotics https://www.britannica.com/technology/automation/Manufacturing-applications-of-automation-and-robotics
	Autonomous systems	https://www.raeng.org.uk/publications/reports/innovation-in-autonomous-systems
	Distributed energy	https://inbuildingtech.com/energy/distributed-energy-systems/ https://www.ofgem.gov.uk/sites/default/files/docs/2008/02/de-non-specialist-summary---final.pdf





Hybrid technologies	https://en.wikipedia.org/wiki/Hybrid_vehicle https://www.toyota.ca/toyota/en/connect/4043/hybrid-technology https://afdc.energy.gov/vehicles/how-do-hybrid-electric-cars-work
Cyber-physical systems	https://en.wikipedia.org/wiki/Cyber-physical_system https://www.nsf.gov/news/special_reports/cyber-physical/
The internet of things	https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/ https://www.youtube.com/watch?v=6mBO2vqLv38 https://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/
Cloud computing	https://searchcloudcomputing.techtarget.com/definition/cloud-computing https://azure.microsoft.com/en-gb/overview/what-is-cloud-computing/?cdn=disable https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-about-the-cloud/
Sustainability (product life cycle, circular economy, exploring alternatives, renewables, waste and disposal)	https://www.tutor2u.net/business/reference/product-life-cycle https://technologystudent.com/prddes1/lifecy1.html https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview https://www.youtube.com/watch?v=zCRKvDyyHmI https://www.edfenergy.com/for-home/energywise/renewable-energy-sources https://www.youtube.com/watch?v=1kUE0BZtTRc

