We cannot imagine the world without communication between persons. So without interacting with each other, there is no possibility of knowledge sharing & different ideas cannot be implemented. A novella was written by an American writer namely "Edward Everett Hale" published in the Atlantic Monthly in the years of 1869 to 1870. He is the only person first talked regarding this communication system. But a Royal Air Force officer namely Arthur C. Clarke has prepared the first practical concept and published this in the paper like 'Extra-Terrestrial Relays'. The initial artificial satellite was initiated effectively by the Soviet Union in the year 1957 October 4 and called Sputnik 1. The diameter of this is 58 cms & was the main to the communication system. By launching Sputnik 1, the Soviet Union brought into attention with other nations. This article discusses an overview of Satellite Communication system, types and applications. What is a Satellite Communication System? The satellite communication definition is, it is one kind of wireless communication which uses artificial satellite to communicate. This kind of communication provides services like voice, internet, video calling, TV, radio channels, Fax, etc. By using this, the communication can be possible for long distances and it can be operated under some conditions and circumstances which are permanent for other kinds of communication. The artificial satellite can be placed within the space to make possible the communication between the different points on the globe. satellite-communication-system The communication can be defined as, the transfer of data from one sender to a receiver who responds accordingly. The communication can be possible in layman's language by using it as a medium among the sender & receiver. Once the receiver gets the signals from the sender, then it decodes and transmits back to the sender to make possible communication method. For instance, communication can be possible using light in an optical communication system, radio signals can be used to communicate in the radio communication system, and telecommunication is used for communication using satellite. This article discusses an overview of the satellite communication system. Types of Satellite Communication The satellite-communication can be classified into three types which include the following. 1). Fixed Satellite This system aids in the data transmitting across the world throughout permanent point on the surface of the earth. 2). Mobile Satellite This system is used in connecting aircraft, ships at remote places. 3). Research Satellite This kind of system is mainly useful in different research methods for the researchers. They gather the required data using the research satellite system. How does it Work? The satellite communication system block diagram mainly include essential components of a satellite communication system like the earth or ground base & space component. This communication system works on the principles of these components. In this type of communication, the satellite is arranged at the space to get the signals from the globe by using an antenna. These signals are improved to the best level and after that, they have transmitted again back to the globe using transponders. Then the earth station gets the signals from the satellite, changes again and assists in communication. Therefore in this type of communication, the satellite assists in the signal transmission from the globe and subsequently back to the globe. Applications of Satellite Communication System This type of communication is used in ships, where mobile phones are not operated. So satellite phones are used in communication. The satellite phones, radios, TVs works on the satellite-communication principle. This kind of communication is mainly used in distant areas wherever broadband amenities fail to work. Thus, this is all about satellite communication. The advantages of this communication mainly include flexibility, easily installed, possibilities of broadcasting, and the network can be controlled by the user. Here is a question for you, what are the drawbacks of satellite communication system? Intelsat VIIntelsat VI, a communications satellite, after being repaired, 1992.A satellite is basically a self-contained communications system with the ability to receive signals from Earth and to retransmit those signals back with the use of a transponder—an integrated receiver and transmitter of radio signals. A satellite has to withstand the shock of being accelerated during launch up to the orbital velocity of 28,100 km (17,500 miles) an hour and a hostile space environment where it can be subject to radiation and extreme temperatures for its projected operational life, which can last up to 20 years. In addition, satellites have to be light, as the cost of launching a satellite is quite expensive and based on weight. To meet these challenges, satellites must be small and made of lightweight and durable materials. They must operate at a very high reliability of more than 99.9 percent in the vacuum of space with no prospect of maintenance or repair. The main components of a satellite consist of the communications system, which includes the antennas and transponders that receive and retransmit signals, the power system, which includes the solar panels that provide power, and the propulsion system, which includes the rockets that propel the satellite. A satellite needs its own propulsion system to get itself to the right orbital location and to make occasional corrections to that position. A satellite in geostationary orbit can deviate up to a degree every year from north to south or east to west of its location because of the gravitational pull of the Moon and Sun. A satellite has thrusters that are fired occasionally to make adjustments in its position. The maintenance of a satellite's orbital position is called "station keeping," and the corrections made by using the satellite's thrusters are called "attitude control." A satellite's life span is determined by the amount of fuel it has to power these thrusters. Once the fuel runs out, the satellite eventually drifts into space and out of operation, becoming space debris. A satellite in orbit has to operate continuously over its entire life span. It needs internal power to be able to operate its electronic systems and communications payload. The main source of power is sunlight, which is harnessed by the satellite's solar panels. A satellite also has batteries on board to provide power when the Sun is blocked by Earth. The batteries are recharged by the excess current generated by the solar panels when there is sunlight. Satellites operate in extreme temperatures from −150 °C (−238 °F) to 150 °C (300 °F) and may be subject to radiation in space. Satellite components that can be exposed to radiation are shielded with aluminium and other radiation-resistant material. A satellite's thermal system protects its sensitive electronic and mechanical components and maintains it in its optimum functioning temperature to ensure its continuous operation. A satellite's thermal system also protects sensitive satellite components from the extreme changes in temperature by activation of cooling mechanisms when it gets too hot or heating systems when it gets too cold. The tracking telemetry and control (TT&C) system of a satellite is a two-way communication link between the satellite and TT&C on the ground. This allows a ground station to track a satellite's position and control the satellite's propulsion, thermal, and other systems. It can also monitor the temperature, electrical voltages, and other important parameters of a satellite. Communication satellites range from microsatellites weighing less than 1 kg (2.2 pounds) to large satellites weighing over 6,500 kg (14,000 pounds). Advances in miniaturization and digitalization have substantially increased the capacity of satellites over the years. Early Bird had just one transponder capable of sending just one TV channel. The Boeing 702 series of satellites, in contrast, can have more than 100 transponders, and with the use of digital compression technology each transponder can have up to 16 channels, providing more than 1,600 TV channels through one satellite. Satellites operate in three different orbits: low Earth orbit (LEO), medium Earth orbit (MEO), and geostationary or geosynchronous orbit (GEO). LEO satellites are positioned at an altitude between 160 km and 1,600 km (100 and 1,000 miles) above Earth. MEO satellites operate from 10,000 to 20,000 km (6,300 to 12,500 miles) from Earth. (Satellites do not operate between LEO and MEO because of the inhospitable environment for electronic components in that area, which is caused by the Van Allen radiation belt.) GEO satellites are positioned 35,786 km (22,236 miles) above Earth, where they complete one orbit in 24 hours and thus remain fixed over one spot. As mentioned above, it only takes three GEO satellites to provide global coverage, while it takes 20 or more satellites to cover the entire Earth from LEO and 10 or more in MEO. In addition, communicating with satellites in LEO and MEO requires tracking antennas on the ground to ensure seamless connection between satellites. A signal that is bounced off a GEO satellite takes approximately 0.22 second to travel at the speed of light from Earth to the satellite and back. This delay poses some problems for applications such as voice services and mobile telephony. Therefore, most mobile and voice services usually use LEO or MEO satellites to avoid the signal delays resulting from the inherent latency in GEO satellites. GEO satellites are usually used for broadcasting and data applications because of the larger area on the ground that they can cover. Launching a satellite into space requires a very powerful multistage rocket to propel it into the right orbit. Satellite launch providers use proprietary rockets to launch satellites from sites such as the Kennedy Space Center at Cape Canaveral, Florida, the Baikonur Cosmodrome in Kazakhstan, Kourou in French Guiana, Vandenberg Air Force Base in California, Xichang in China, and Tanegashima Island in Japan. Satellite communications use the very high-frequency range of 1–50 gigahertz (GHz; 1 gigahertz = 1,000,000,000 hertz) to transmit and receive signals. The frequency ranges or bands are identified by letters: (in order from low to high frequency) L-, S-, C-, X-, Ku-, Ka-, and V-bands. Signals in the lower range (L-, S-, and C-bands) of the satellite frequency spectrum are transmitted with low power, and thus larger antennas are needed to receive these signals. Signals in the higher end (X-, Ku-, Ka-, and V-bands) of this spectrum have more power; therefore, dishes as small as 45 cm (18 inches) in diameter can receive them. This makes the Ku-band and Ka-band spectrum ideal for direct-to-home (DTH) broadcasting, broadband data communications, and mobile telephony and data applications. The International Telecommunication Union (ITU), a specialized agency of the United Nations, regulates satellite communications. The ITU, which is based in Geneva, Switzerland, receives and approves applications for use of orbital slots for satellites. Every two to four years the ITU convenes the World Radiocommunication Conference, which is responsible for assigning frequencies to various applications in various regions of the world. Each country's telecommunications regulatory agency enforces these regulations and awards licenses to users of various frequencies. In the United States the regulatory body that governs frequency allocation and licensing is the Federal Communications Commission. Enjoy sharper detail, more accurate color, lifelike lighting, believable backgrounds, and more with our new model update. Your generated images will be more polished than ever.See What's NewExplore how consumers want to see climate stories told today, and what that means for your visuals.Download Our Latest VisualGPS ReportData-backed trends. Generative AI demos. Answers to your usage rights questions. 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Our original video podcast covers it all—now on demand.Watch Now Satellite communication systems have revolutionized the way we connect and interact in today's world. With the ability to transmit data over vast distances, these systems play a pivotal role in various applications, including telecommunications, broadcasting, and internet services. This blog post will delve into the intricacies of satellite communication, its components, types, applications, and future trends.At its core, satellite communication involves the transmission of data through satellites orbiting the Earth. These satellites act as relay stations, receiving signals from one location, amplifying them, and sending them to another location on the Earth's surface. The beauty of satellite communication lies in its ability to facilitate global connectivity, providing a platform for communication in even the most remote areas.Large satellite dish receiving communication signalsThe basic operational principle involves three main components: the ground station, the satellite, and the user terminal. The ground station sends out signals to the satellite, which then retransmits the signals to the user terminal. This system is especially beneficial in areas where traditional communication infrastructure is not available.Understanding the components of satellite communication is crucial for grasping how these systems work effectively. Here are the key components:Satellites are the heart of communication systems. They can be categorized based on their orbit: geostationary, medium Earth orbit, and low Earth orbit. Geostationary satellites remain fixed relative to a point on the Earth, usually located about 35,786 kilometers above the Equator. This allows for continuous communication with a specific area.Medium Earth orbit satellites operate at altitudes between 2,000 and 36,000 kilometers. They are typically used for navigation systems.Low Earth orbit satellites orbit at altitudes of 160 to 2,000 kilometers, providing broader bandwidth and lower latency, ideal for internet services.Ground stations are equipped with antennas and other electronic equipment. They transmit the data signals to the satellite and receive signals back from it. A ground station can be located at various types of facilities, ranging from small antennas to large communication hubs.User terminals are the devices that facilitate end-user access to satellite communication. These can be simple satellite phones or complex systems used in aircraft and ships. User terminals can vary greatly in size and functionality, from small handheld devices to large satellite dishes.Satellite ground station with large antennas for signal transmissionThe communication process generally follows these steps:Signal Transmission: The process begins when the ground station sends a data signal to the satellite in space. Signal Reception and Amplification: Upon receiving the signal, the satellite amplifies it to ensure that it is strong enough to be sent back to the Earth.Signal Transmission to User Terminals: The satellite then directs the amplified signal back down to the designated user terminal, where it is translated into usable data.This mechanism allows for the transmission of various data forms, including voice, video, and internet.Satellite communication systems have an array of applications across different sectors. Here are some notable ones:Telecommunication companies leverage satellite communication to provide services in areas where laying cables is not feasible. This is crucial for maintaining continuous communication in rural and isolated regions.Satellite broadcasting is a popular method for delivering television signals. It allows users to access a wide variety of channels, often with better quality and fewer interruptions compared to terrestrial broadcasting.Satellites equipped with various sensors gather data about the Earth's surface. This information is vital for weather forecasting, agricultural monitoring, and disaster management, enabling timely and efficient responses to natural calamities.Satellites underpin global navigation systems like GPS. They provide positioning and time data for navigation purposes, which are essential in transportation, military operations, and emergency services.With the expansion of low Earth orbit satellites, internet services have become more accessible globally. Companies like Starlink aim to provide high-speed internet to underserved areas, transforming connectivity efforts worldwide.Satellite in orbit with extended solar panels for energyDespite its advantages, satellite communication is not without challenges. Here are some common issues:Due to the distance signals must travel, there can be a noticeable delay in communication, especially with geostationary satellites. This latency can hinder applications requiring real-time interactions like online gaming.Weather conditions can impact the quality of signals. Rain, snow, or heavy clouds may weaken the signal strength, leading to disruptions.While satellite communication provides extensive coverage, it often suffers from limited bandwidth, affecting data transfer rates. This limitation can be problematic, especially during peak usage times.The infrastructure required for satellite communication, including satellite development and launching, can be expensive. This cost can affect service providers and end-users alike.As technology advances, the future of satellite communication looks promising. With innovations such as smaller, more powerful satellites and the concepts of mega-constellations, we can expect improvements in connectivity, coverage, and data speeds. Companies are exploring ways to reduce launch costs and make satellite communication more accessible to everyone. Projects like **Iridium** aim to enhance global communication networks and ensure that remote locations are not left behind in the digital age.Moreover, advancements in AI and machine learning are projected to boost operational efficiencies in satellite communication systems, allowing better predictive maintenance and enhanced signal processing.In summary, satellite communication systems are integral to modern connectivity and will continue to evolve, making global communication more accessible, efficient, and reliable. As we embrace these technologies, it is vital to consider their implications and leverage them effectively to overcome existing challenges and pave the way for a more connected future. Satellite communication is transporting information from one place to another using a communication satellite in orbit around the Earth. Watching the English Premier League every weekend with your friends would have been impossible without this. A communication satellite is an artificial satellite that transmits the signal via a transponder by creating a channel between the transmitter and the receiver at different Earth locations. Telephone, radio, television, internet, and military applications use satellite communications. Believe it or not, more than 2000 artificial satellites are hurtling around in space above your heads. We know that there are different ways to communicate, and the propagation of these waves can occur in different ways. Ground wave propagation and skywave propagation are the two ways communication takes place for a certain distance. The maximum distance covered by them is 1500 km, which was overcome by the introduction of satellite communication. The communication satellites are similar to the space mirrors that help us bounce signals such as radio, internet data, and television from one side of the earth to another. Three stages are involved, which explain the working of satellite communications. These are: Uplink Transponders Downlink Let's consider an example of signals from a television. In the first stage, the signal from the television broadcast on the other side of the earth is first beamed up to the satellite from the ground station on the earth. This process is known as uplink. The second stage involves transponders such as radio receivers, amplifiers, and transmitters. These transponders boost the incoming signal and change its frequency so that the outgoing signals are not altered. Depending on the incoming signal sources, the transponders vary. The final stage involves a downlink in which the data is sent to the other end of the receiver on the earth. It is important to understand that usually, there is one uplink and multiple downlinks. It's interesting to know that the Indian National Satellite (INSAT) system is one of the largest domestic communication systems that is placed in the geo-stational orbit. There are more than 200 transponders in the INSAT system and are used for various purposes such as telecommunications, weather forecasting, television broadcasting, disaster warning, search and rescue operations, and satellite newsgathering. Below is the list of communication satellites along with their applications: Satellite name Launch date Application GSAT-30 Jan 17, 2020 Communication GSAT-31 Feb 06, 2020 Communication GSAT-15 Nov 11, 2015 Communication and navigation GSAT-10 Sep 29, 2012 Communication and navigation INSAT-3A Apr 10, 2003 Communication and climate and environment KALPANA-1 Sep 12, 2002 Communication and climate and environment The need for satellite communication becomes evident when we want to transmit the signal to far-off places, where the Earth's curvature comes into play. This obstruction is overcome by putting communication satellites in space to transmit the signals across the curvature. Satellite communication uses two types of artificial satellites to transmit the signals: Passive Satellites: If you put a hydrogen balloon that has a metallic coating over it up in the air, it technically becomes a passive satellite. Such a balloon can reflect microwave signals from one place to another. The passive satellites in space are similar. These satellites just reflect the signal back towards the Earth without amplification. Since the satellite orbit height can range from 2000 to 35786 km, attenuation due to the atmosphere also comes into play, and due to this, the received signal is often very weak. Active Satellites: Active Satellites, unlike passive satellites, amplify the transmitted signals before re-transmitting it back to Earth, ensuring excellent signal strength. Passive satellites were the earliest communication satellite, but now almost all the new ones are active satellites. To avoid mixing up and interference signals, every user is allocated a specific frequency for transmitting. The International Telecommunication Union does this frequency allocation. Geosynchronous satellites are of note here. Geostationary orbit is present at 35786 km above Earth's surface. If you can spot such a satellite with a telescope from Earth, it will appear stationary to you. The satellite's orbital period and the Earth's rotational rate are in sync. Put your understanding of this concept to test by answering a few MCQs. Click 'Start Quiz' to begin! Select the correct answer and click on the "Finish" buttonCheck your score and answers at the end of the quiz Visit BYJU'S for all Physics related queries and study materials 0 out of 0 arewrong 0 out of 0 are correct 0 out of 0 are Unattempted View Quiz Answers and Analysis In 2007, China launched a communications satellite for Nigeria, the first of its kind in Africa and the first time a foreign buyer has purchased a Chinese satellite and its launching service. AP Photo – Xinhua, Li Gang Space has become an attractive frontier for African countries that have launched satellites based on scientific, technological or military ambitions. Nigeria uses satellite technology in its fight against the terrorist group Boko Haram, attempting to record movement in the region where the Jihadist group is most active. South Africa uses satellites to monitor the weather and evaluate images of forest fires. Listen to GHOGH with Jamarlin Martin | Episode 38: Tony Effik Jamarlin talks to Tony Effik, SVP of Client Strategy at NBCUniversal, about where the digital media business is going. Tony talks about directing strategy across the largest multi-billion dollar media portfolio, opportunities with subscriptions, and the business of podcasting. While local engineers and scientists are often involved in the development of the satellites, cooperation with other countries such as China, Russia and Japan has historically been necessary to successfully launch satellites into space. Here are 10 African countries with a presence in space or plans to launch satellites in the near future. Rwanda plans to have its second satellite in orbit in July. The RWASAT is expected to launch into lower orbit. Made by Tokyo University in partnership with a team of 15 Rwandan engineers, the Rwandan satellite will be used in agriculture development, ThisIsAfrica reports. The country successfully launched its first satellite in February 2019. Working with a U.K.-based company OneWeb, it launched Icyerekezo, the first-ever satellite that connects remote schools to the internet, according to Face2FaceAfrica. In late 2018, Morocco launched its second surveillance satellite, the Mohammed VI-B, from the spaceport in French Guiana in cooperation with French company Arianespace. The Mohammed VI-A satellite, the country's first, was launched in 2017 from Kourou in French Guinea on a Vega rocket built by Airbus Defense and Space and Thales Alenia Space, Space News reported. One of the most active African countries in space technology, Algeria has six satellites in orbit. The most recent launch was in 2017 when the Algerian Space Agency launched a telecoms satellite into space in cooperation with China. The Alcomsat-1, which began operating in 2018, supports TV broadcasting and provides broadband communications for education, e-government, and other services, according to ITWebAfrica. In September 2016, three Algerian satellites – Alsat-1B, Alsat-2B and Alsat-1N – were launched by an Indian polar satellite launch vehicle in cooperation with Indian Space Research Organisation, according to SpaceWatch. Ethiopia does not have a satellite in space but will soon have two orbiting earth. China recently promised to pay $6 billion of the $8 billion expense to build and launch a second Ethiopian communication satellite in space. The first is an earth observatory satellite called ETRSS-1. It is expected to launch from China in October 2019, BusinessEthiopia reports. Engineers from both countries plan to jointly design, develop and manufacture the second satellite in Ethiopia, according to ITNewsAfrica. In May 2018, Kenya launched its first satellite into orbit. The locally produced 4-inch CubeSat, known as the First Kenya University Nano-Satellite – Precursor Flight (1KUNS-PF), was developed by students and researchers of the University of Nairobi in partnership with the Japanese Space Agency. It was launched from the International Space Station after being delivered to the station by a SpaceX Falcon 9 rocket, according to BBC. Four private NileSat satellites were launched into orbit as communication satellites between 1998 and 2010. In addition, Egypt has launched three government-owned satellites into space. Only one is operational. In February 2019 the EgyptSat-A high-resolution earth observation satellite was launched into space. It was developed by Russian corporation RSC Energia on behalf of Egypt's National Authority for Remote Sensing and Space Sciences, according to Spaceflight. That satellite was a replacement for the EgyptSat 2, an imaging satellite built by RSC Energia that launched in April 2014. It was lost later that month due to a flight control system failure and was replaced by the Russian company in 2019. The EgyptSat 1, Egypt's first earth remote sensing satellite, was built jointly by Egypt's National Authority for Remote Sensing and Space Sciences and the Yuzhnoye Design Bureau in Ukraine. It was launched in 2007 but communication and control of the satellite was lost in 2010. Ghana's first satellite was launched into orbit in 2017 from the International Space Station. GhanaSat-1 was developed by students at All Nations University in Koforidua, Ghana. The satellite launch was a two-year project, costing $500,000, according to BBC. The successful project was supported by the Japanese Space Agency which also helped launch Kenya's first satellite in 2018. Angola's first satellite was launched in December 2017 but declared defunct by Russia four months later. The AngoSat-1, a communications satellite built for almost $300 million, was launched from the Baikonur cosmodrome in Kazakhstan. The project had several technical issues after launch. Russian company RSC Energia, which built the satellite on behalf of Angola, committed to building a more powerful replacement at no cost, thanks to AngoSat-1's insurance policy, according to AlJazeera. In December 2018, South Africa launched the continent's most advanced nanosatellite into space to monitor and manage disasters such as fires and assist the ocean economy. The ZACube-2 nanosatellite provides state-of-the-art remote sensing and communication services to South Africa and the southern African region, according to Techcentral. That is the second government-owned nanosatellite South Africa has launched into space. The first was the TshepisoSat, which was launched in 2013, according to theSASTA. Along with South Africa, Nigeria's space program is more advanced than its African peers. Nigeria has launched four satellites into space, with three still operational and one deorbited after completing its objectives. Nigeria launched its first earth observation satellite, NigeriaSat-1, in September 2003. Launched by Kosmos-3M rocket from Russian Plesetsk spaceport, it cost the country $30 million, AllAfrica reports. That was followed by the launch of Africa's first communications satellite, NigComSat-1, built and launched in China in 2007. Earth observation satellites NigeriaSat-2 and NigeriaSat-X were then sent into orbit by the Ukrainian Dnepr rocket from Yasny military base in Russia on August 17, 2011. These have been used to monitor activities of terrorist group Boko Haram, according to DW. Over the years, satellite communication systems—also known as satcom systems—have become increasingly important to our day-to-day lives. Since they allow people to communicate through voice and video reliably even with variable information rates and from the most difficult-to-reach areas, the demand for them has grown among consumers, businesses, and military agencies. Parts of a Satellite Communication System Satellite communication systems consist of space-based components and earth-based components, all of which work together to transfer, receive, and process the signals needed for communication. Key components include: Antennas. These components receive and transmit signals between Earth and the satellite. Command and data control systems. These components are used to monitor and control the satellite from Earth. Guidance and stabilization systems. These components are used to monitor the position of the satellite to ensure it stays in the right orbit and orientation. Housings. These components protect the sensitive satellite components from the harsh conditions in space. Power systems. These components provide energy to the satellite. Thermal control systems. These components protect the satellite from extreme changes in temperature. Transponders. These components convert incoming signals and amplify outgoing signals. Importance of Precision Machined Parts for Satellite Communications Given the essential role satellite communication systems play in our daily activities, it is important they function and perform as intended. Achieving this goal necessitates carefully designed and constructed components. Each one must be built to a high degree of precision and accuracy. Otherwise, it may not work properly within the assembled satellite. That's why many satellite manufacturers rely on precision machining for their parts and products. While precisely machined components help satellites operate optimally, imprecisely machined components can cause spotty voice and video communications. Common Parts for Satellite Communications Systems Satellite communication systems are made up of many components. The ones that are commonly manufactured using precision machining include: Housings and chassis parts. The chassis provides support and structure to the other satellite components, while the housing protects them from harsh environmental conditions. Panels and brackets. The panels and brackets that make up a satellite communication system, both on the ground and in orbit, must be capable of withstanding extended exposure to harsh environmental and operating conditions. Additionally, they must fit cleanly, without gaps or overlap, to prevent the ingress of contaminants. Flanges and fittings. Flanges and fittings must be exceptionally precise and accurate. The smallest gap or inconsistency can reduce the performance and service life of critical satcom equipment. Antenna reflector hardware. Antenna reflectors require fine control to ensure optimal communication between the moving satellite and stationary earthbound receivers. Hardware for these reflectors must therefore be designed, manufactured, and installed with exceptional precision. Complex waveguide satellite parts. The complex arrays used in waveguide satellites must be exceptionally precise to ensure efficient and accurate signal transmission. Learn More About Precision Machined Satellite Communication System Components From Ardel Engineering Want more information on precision machined satellite communication system components? Ask the experts at Ardel Engineering. Equipped with extensive experience providing precision machining services to customers in a diverse set of industries, including communications, we can answer or address any questions or concerns you may have about the topic. If you have an upcoming satellite communication system project, contact us to learn about how our precision machining capabilities can benefit you or request a quote to discuss your requirements with one of our team members. In general terms, a satellite is a smaller object that revolves around a larger object in space. For example, moon is a natural satellite of earth. We know that Communication refers to the exchange (sharing) of information between two or more entities, through any medium or channel. In other words, it is nothing but sending, receiving and processing of information. If the communication takes place between any two earth stations through a satellite, then it is called as satellite communication. In this communication, electromagnetic waves are used as carrier signals. These signals carry the information such as voice, audio, video or any other data between ground and space and vice-versa. Soviet Union had launched the world's first artificial satellite named, Sputnik 1 in 1957. Nearly after 18 years, India also launched the artificial satellite named, Aryabhata in 1975. Need of Satellite Communication The following two kinds of propagation are used earlier for communication up to some distance. Ground wave propagation − Ground wave propagation is suitable for frequencies up to 30MHz. This method of communication makes use of the troposphere conditions of the earth. Sky wave propagation − The suitable bandwidth for this type of communication is broadly between 3040 MHz and it makes use of the ionosphere properties of the earth. The maximum hop or the station distance is limited to 1500KM only in both ground wave propagation and sky wave propagation. Satellite communication overcomes this limitation. In this method, satellites provide communication for long distances, which is well beyond the line of sight. Since the satellites locate at certain height above earth, the communication takes place between any two earth stations easily via satellite. So, it overcomes the limitation of communication between two earth stations due to earth's curvature. How a Satellite Works A satellite is a body that moves around another body in a particular path. A communication satellite is nothing but a microwave repeater station in space. It is helpful in telecommunications, radio and television along with internet applications. A repeater is a circuit, which increases the strength of the received signal and then transmits it. But, this repeater works as a transponder. That means, it changes the frequency band of the transmitted signal from the received one. The frequency with which, the signal is sent into the space is called as Uplink frequency. Similarly, the frequency with which, the signal is sent by the transponder is called as Downlink frequency. The following figure illustrates this concept clearly. The transmission of signal from first earth station to satellite through a channel is called as uplink. Similarly, the transmission of signal from satellite to second earth station through a channel is called as downlink. Uplink frequency is the frequency at which, the first earth station is communicating with satellite. The satellite transponder converts this signal into another frequency and sends it down to the second earth station. This frequency is called as Downlink frequency. In similar way, second earth station can also communicate with the first one. The process of satellite communication begins at an earth station. Here, an installation is designed to transmit and receive signals from a satellite in an orbit around the earth. Earth stations send the information to satellites in the form of high powered, high frequency (GHz range) signals. The satellites receive and retransmit the signals back to earth where they are received by other earth stations in the coverage area of the satellite. Satellite's footprint is the area which receives a signal of useful strength from the satellite. Pros and Cons of Satellite Communication In this section, let us have a look at the advantages and disadvantages of using satellite communication. Following are the advantages of using satellite communication: Area of coverage is more than that of terrestrial systems Each and every corner of the earth can be covered Transmission cost is independent of coverage area More bandwidth and broadcasting possibilites Following are the disadvantages of using satellite communication − Launching of satellites into orbits is a costly process. Propagation delay of satellite systems is more than that of conventional terrestrial systems. Difficult to provide repairing activities if any problem occurs in a satellite system. Free space loss is more There can be congestion of frequencies. Applications of Satellite Communication Satellite communication plays a vital role in our daily life. Following are the applications of satellite communication − Radio broadcasting and voice communications TV broadcasting such as Direct To Home (DTH) Internet applications such as providing Internet connection for data transfer, GPS applications, Internet surfing, etc. Military applications and navigations Remote sensing applications Weather condition monitoring & Forecasting GMSS stands for Global Mobile Satellite System. An artificial body which is placed in an orbit around the Earth for the purpose of communication is known as Communication satellite. GMSS is a system which consists of various artificial communication satellites orbiting around the Earth to provide the communication services. A satellite network is a combination of nodes that provides communication from one point on the Earth to another. A node in the network can be Satellite, an Earth station, or an End-user terminal or Telephone. Satellite networks are like cellular networks, they divide the planet into cells. The frequencies reserved for the satellite microwave communication are in gigahertz(GHz) range. Each satellite sends and receives over two different bands. Transmission from the earth to the satellite is called the Uplink. Transmission from the satellite to the earth is called the Downlink. Satellite frequency bands Uplink and downlink frequencies must be different to avoid interference. Now, stations at the earth have greater power sources than that of satellite as it has only solar power. Also, higher frequency results in higher attenuation and to compensate with it more power is required. So, uplink uses higher frequency to penetrate the environment. Satellite Orbits: Orbit An artificial satellite needs to have an orbit, the path in which it travels around the Earth. The orbit can be equatorial, inclined or polar. Footprint Satellite process microwaves with bidirectional antennas. Therefore, the signal from the satellite is normally aimed at a specific area called the footprint. Satellite Categories Based on the location of the orbit, satellites can be divided into three categories as follows GEO: GEO stands for Geostationary Earth Orbit. The communication satellites in this orbit operates at a distance of about 36000 km above the earth's surface and their orbital time period is about 24 hours.Geostationary Orbit Satellites are used for radio broadcasting.To ensure constant communication, the satellite must move at the same speed as the earth, so that it seems to remain fixed above a certain spot. So such satellites are called geostationary.One geostationary satellite cannot cover the whole earth. One satellite in orbit has line-of-sight contact with vast number of stations, but the curvature of the Earth still keeps much of the planet out of sight. It takes minimum of three satellites equidistant from each other in geostationary Earth Orbit(GEO) to provide full global transmission. MEO: MEO stands for Medium Earth Orbit. The communication satellites in this orbit operates at a distance of about 5000 to 12000 km above the earth's surface. These satellites are positioned between the two Van Allen belts. A satellite at this orbit takes approximately 6 to 8 hours to circle the Earth.One Example of a MEO satellite system is Global Positioning System(GPS), constructed and operated by US Department of Defense, orbiting at an altitude about 18,000 km above the earth.The system consists of 24 satellites and is used for land, sea and air navigation to provide time and locations for vehicle and ships.The orbits and the locations of the satellites in each orbit are designed in such a way that, at any time, four satellites are visible from any point on the Earth. A GPS receiver has a almanac that tells the current position of each satellite.GPS is based on a principle called Trilateration(also sometimes called Triangulation). Principle states that "On a plane, if we know our distance from three points, we know exactly where we are." LEO: LEO stands for Low Earth Orbit.The communication satellites in this orbit operates at a distance of about 500 to 1200 km above the earth's surface and their orbital time period generally ranges between 95 to 120 minutes. The Satellite has a speed of 20,000 to 25,000 km/h. Low Orbit Satellites makes global radio coverage possible.An LEO system is made of a constellation of satellites that work together as a network, each satellite acts as a switch. Satellites that are close to each other are connected through inter-satellite links (ISLs). A mobile system communicates with the satellite through a user mobile link(UML). A satellite can also communicate with an Earth station(gateway) through a gateway link(GWL).LEO satellites can be divided into three categories: Little LEOs, Big LEOs, and Broad Band LEOs.Little LEOs operate under 1GHz. They are mostly used for low-data-rate messaging.Big LEOs operate between 1 and 3GHz. Globalstar and Iridium system are examples of Big LEOs.Broad Band LEOs provide communication similar to fiber-optic networks. The first broadband LEO system was Teledesic. IRIDIUM: The concept of Iridium system, a 77-satellite network, was started by Motorola in 1990. The project took 8 years to materialize.Finally in 1998, the service was started by 66 satellites. The original name, Iridium, came from the name of the 77th chemical element. A more appropriate name is Dysprosium (the name of 66th element).The System has 66 satellites divided into 6 orbits, with 11 satellites in each orbit. The orbits are at an altitude of 750km.Iridium is designed to provide direct worldwide voice and data communication using handheld terminals, a service similar to cellular telephony but on a global scale. Globalstar: Globalstar is LEO satellite system that uses 48 satellites in six polar orbits with each orbit hosting eight satellites. The orbits are located at an altitude of almost 1400km. The Globalstar system is similar to the Iridium system, the main difference is the relaying mechanism.Communication between two distinct users in Iridium system requires relaying between several satellites.Globalstar communication requires both satellites and earth station, which means that ground stations can create more powerful signals. Teledesic: Teledesic is a system of satellites that provides fiber-optic like communication.Its main purpose is to provide broadband Internet access for users all over the world. It is sometimes called "Internet in the sky".The project was started in1990 by Craig McCaw and Bill Gates, later other investors joined the consortium. Teledesic has 288 satellites in 12 LEO orbits, each at an altitude of 1350km.The commercial failure of the similar Iridium and Globalstar ventures and other systems, along with bankruptcy protection fillings, were the primary factors in halting this project, and Teledesic officially suspended its satellite construction work on 1 October 2002. DSA to Development: A Complete GuideBeginner to AdvanceJAVA Backend Development - LiveIntermediate and AdvanceFull Stack Development with React & Node JS - Project Based TrainingBeginner to AdvanceTech Interview 101 - From DSA to System Design for Working ProfessionalsBeginner to AdvanceC++ Programming Course Online - Complete Beginner to AdvancedBeginner to AdvanceJava Programming Online Course [Complete Beginner to Advanced]Beginner to AdvancePage 2Our website uses cookiesWe use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy , the free encyclopedia that anyone can edit. 107,766 active editors 7,028,600 articles in English Liz Truss (born 26 July 1975) is a British politician who was prime minister from September to October 2022. A Liberal Democrat in her youth, she defected to the Conservatives in 1996. After several bids for public office she was elected as an MP in 2010 and served continuously in government in the Cameron, May and Johnson ministries, latterly as foreign secretary. After Johnson resigned in July 2022 Truss stood in the election to replace him, defeating Rishi Sunak and becoming the leader of the party. Two days after her appointment as prime minister Queen Elizabeth II died, freezing government business for ten days during a national mourning period; after its conclusion Truss's ministry announced a mini-budget which was received badly by markets, the fallout from which subsequently engulfed her government. Facing a rapid loss of confidence in her leadership, Truss resigned fifty days into her premiership and was succeeded by Sunak, becoming the shortest-serving British prime minister. (Full article...) Recently featured: Lesley J. McNair Second Test, 1948 Ashes series Daily News Building Archive By email More featured articles About USS Sabine, which took 35 years to finish ... that the Potomac-class frigates (example pictured) were built slowly for the sake of quality, only for the last ships to be outdated by the time they were finished? ... that Indonesian mystic Mbah Suro reportedly consumed only coffee and cigarettes for two years? ... that the United States' first capitol building was later sold for $425 and then demolished? ... that the mascot of an Australian HIV prevention campaign was a condom-wielding superhero? ... that Audichron estimated that Don Elliot Heald's voice was heard on 12 million Audichron phone calls a day in 1971? ... that the British indie rock band Girl Ray named themselves after the surrealist visual artist Man Ray? ... that avery r. young became the first poet laureate of Chicago in 2023? ... that by spinning off Lord Fitzhenry (1794) from a four-volume work in progress, Elizabeth Gunning was paid for two novels instead of one? ... that American Civil War chaplain Thomas Mooney was pulled from service after baptizing a cannon? Archive Start a new article Nominate an article Ozzy Osbourne Armed clashes erupt in the Cambodia–Thailand border conflict. Ozzy Osbourne (pictured), the lead singer of Black Sabbath, dies at the age of 76. A fighter jet crashes into a college in Dhaka, Bangladesh, killing more than 30 people. In golf, Scottie Scheffler wins the Open Championship. A tourist boat capsizes during a thunderstorm in Hạ Long Bay, Vietnam, leaving at least 36 people dead. Ongoing: Gaza war Russian invasion of Ukraine timeline Sudanese civil war timeline Recent deaths: Chuck Mangione Hulk Hogan Thomas Anthony Durkin Giora Epstein Béatrice Uria-Monzon Rex White Nominate an article July 26: Independence Day in the Maldives (1965), Kargil Vijay Diwas in India Hillary Clinton 1551 – The Knights Hospitaller surrendered the Castello of Gozo to the Ottoman Empire following a brief siege, leading to the mass enslavement and dispersal of the Gozitan population. 1778 – On the orders of Catherine the Great the first of tens of thousands of Greek and Armenian Christians were removed from Crimea and resettled in Pryazovia. 1953 – In Short Creek, Arizona, police conducted a mass arrest of approximately 400 Mormon fundamentalists for polygamy. 1993 – Asiana Airlines Flight 733 crashed into a mountain during a failed attempt to land at Mokpo Airport, South Korea, leading to the deaths of 68 people on board. 2016 – Hillary Clinton (pictured) became the first female nominee for president of the United States by a major political party at the Democratic National Convention in Philadelphia. Carl Jung (b. 1875)Ana María Matute (b. 1925)George W. Romney (d. 1995)Olivia de Havilland (d. 2020) More anniversaries: July 25 July 26 July 27 Archive By email List of days of the year About Cytoplasmic streaming is a biological process in which cytoplasm flows inside a cell, driven by forces from the cytoskeleton. It is usually observed in large plant and animal cells, as well as amoebae, fungi, and slime moulds. It is likely that its function is, at least in part, to speed up the transport of molecules and organelles around the cell. The process was first discovered by the Italian scientist Bonaventura Corti in 1774, within the algae genera Nitella and Chara. While its mechanism is not fully understood, what is clearly visible in plant cells which exhibit cytoplasmic streaming is the motion of the chloroplasts moving with the cytoplasmic flow. This motion results from fluid being entrained by moving motor molecules of the plant cell. This video, taken through a microscope, shows cytoplasmic streaming occurring in an onion epidermal cell. Video credit: Heiti Paves Recently featured: Hudson Yards Emperor angelfish Amália Rodrigues Archive More featured pictures Community portal – The central hub for editors, with resources, links, tasks, and announcements. Village pump – Forum for discussions about Wikipedia itself, including policies and technical issues. Site news – Sources of news about Wikipedia and the broader Wikimedia movement. Teahouse – Ask basic questions about using or editing Wikipedia. Help desk – Ask questions about using or editing Wikipedia. Reference desk – Ask research questions about encyclopedic topics. Content portals – A unique way to navigate the encyclopedia. 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Many other Wikipedias are available; some of the largest are listed below. 1,000,000+ articles العربية Deutsch Español فارسی Français Italiano Nederlands 日本語 Polski Português Русский Svenska Українська Tiếng Việt 中文 250,000+ articles Bahasa Indonesia Bahasa Melayu Bân-lâm-gú Български Català Čeština Dansk Eesti Ελληνικά Esperanto Euskara עברית Հայերեն Magyar Norsk bokmål Română Simple English Slovenčina Srpski Srpskohrvatski Suomi Türkçe Oʻzbekcha 50,000+ articles Asturianu Azərbaycanca [illegible] Bosanski کوردی Frysk Gaeilge Galego Hrvatski ქართული Kurdî Latviešu Lietuvių [illegible] Македонски [illegible] Norsk nynorsk [illegible] Shqip Slovenščina [illegible] اردو Retrieved from " 2 This article is about the year 1965. For other uses, see 1965 (disambiguation). 1965 January February March April May June July August September October November December From top to bottom, left to right: The Vietnam War escalates as the United States begins regular bombing campaigns in Operation Rolling Thunder and deploys ground combat troops for the first time; the Indo-Pakistani War of 1965 erupts over Kashmir, drawing international concern and resulting in thousands of casualties before a UN-brokered ceasefire; the Voting Rights Act of 1965 is signed into law by President Lyndon B. Johnson, prohibiting racial discrimination in voting; Malcolm X is assassinated while delivering a speech in New York City, silencing one of the most influential and controversial voices in the civil rights movement; the Dominican Civil War breaks out as constitutionalist and loyalist factions clash, prompting a U.S. military intervention amid fears of a second Cuba; former British Prime Minister Winston Churchill dies at the age of 90, prompting a global outpouring of tributes and a state funeral attended by world leaders; the Battle of Ia Drang becomes the first major battle between U.S. and North Vietnamese forces, signaling a new phase of intense ground combat in the Vietnam War; the Indonesian mass killings of 1965–66 begin following an attempted coup, leading to the deaths of an estimated 500,000 to 1,000,000 people in a brutal anti-communist purge; the Selma to Montgomery marches for voting rights take place in Alabama, culminating in the violent crackdown known as Bloody Sunday and ultimately leading to new federal protections. Calendar year Years Millennium 2nd millennium Centuries 19th century 20th century 21st century Decades 1940s 1950s 1960s 1970s 1980s Years 1962 1963 1964 1965 1966 1967 1968 vte 1965 by topic Subject Animation Archaeology Architecture Art Aviation Awards Comics Film Literature Poetry Meteorology Music Country Jazz Rail transport Radio Science Spaceflight Sports Football Television American Belgian Brazilian British Scottish Canadian Danish Irish Italian By country Afghanistan Argentina Australia Belgium Brazil Bulgaria Canada Denmark France Germany India Indonesia Ireland Iran Israel Italy Japan Kuwait Luxembourg Malaysia New Zealand Norway Pakistan Philippines Portugal Singapore South Africa South Korea Soviet Union Spain Sweden Switzerland Thailand Turkey United Kingdom United States Lists of leaders Sovereign states Sovereign state leaders Territorial governors Religious leaders Law Birth and death categories Births Deaths Establishments and disestablishments categories Establishments Disestablishments Works category Works Introductions vte 1965 in various calendarsGregorian calendar1965MCMLXVAb urbe condita2718Armenian calendar1414ԹՎ ՌՆԺԴAssyrian calendar6715Baháʼí calendar121–122Balinese saka calendar1886–1887Bengali calendar1371–1372Berber calendar2915British Regnal year13 Eliz. 2 – 14 Eliz. 2Buddhist calendar2509Burmese calendar1327Byzantine calendar7473–7474Chinese calendar甲辰年 (Wood Dragon)4662 or 4455 — to —乙巳年 (Wood Snake)4663 or 4456Coptic calendar1681–1682Discordian calendar3131Ethiopian calendar1957–1958Hebrew calendar5725–5726Hindu calendars - Vikram Samvat2021–2022 - Shaka Samvat1886–1887 - Kali Yuga5065–5066Holocene calendar11965Igbo calendar965–966Iranian calendar1343–1344Islamic calendar1384–1385Japanese calendarShōwa 40(昭和４０年)Javanese calendar1896–1897Juche calendar54Julian calendarGregorian minus 13 daysKorean calendar4298Minguo calendarROC 54民國54年Nanakshahi calendar497Thai solar calendar2508Tibetan calendar[illegible](male Wood-Dragon)2091 or 1710 or 938 — to —[illegible] (female Wood-Snake)2092 or 1711 or 939 Wikimedia Commons has media related to 1965. 1965 (MCMLXV) was a common year starting on Friday of the Gregorian calendar, the 1965th year of the Common Era (CE) and Anno Domini (AD) designations, the 965th year of the 2nd millennium, the 65th year of the 20th century, and the 6th year of the 1960s decade. Calendar year Main article: January 1965 Main article: February 1965 January 14 – The First Minister of Northern Ireland and the Taoiseach of the Republic of Ireland meet for the first time in 43 years. January 20 Lyndon B. Johnson is sworn in for a full term as President of the United States. Indonesian President Sukarno announces the withdrawal of the Indonesian government from the United Nations. January 29 – Hakametsä, the first ice rink of Finland, is inaugurated in Tampere.[1] January 30 – The state funeral of Sir Winston Churchill takes place in London with the largest assembly of dignitaries in the world until the 2005 funeral of Pope John Paul II.[2] February 4 – Trofim Lysenko is removed from his post as director of the Institute of Genetics at the Academy of Sciences in the Soviet Union. Lysenkoist theories are now treated as pseudoscience.[3][4] February 12 – The African and Malagasy Common Organization (Organization Commune Africaine et Malgache; OCAM) is formed as successor to the Afro-Malagasy Union for Economic Cooperation (Union Africaine et Malgache de Cooperation Economique; UAMCE), formerly the African and Malagasy Union (Union Africaine et Malgache; UAM). February 18: Flag of the newly independent Gambia February 15 – The maple leaf is adopted as the flag of Canada, replacing the Canadian Red Ensign flag. February 18 – The Gambia becomes independent from the United Kingdom. February 20 Ranger 8 crashes into the Moon, after a successful mission of photographing possible landing sites for the Apollo program astronauts. Suat Hayri Ürgüplü forms the new (interim) government of Turkey (29th government). February 21 – Malcolm X is gunned down while giving a speech at the Audubon Ballroom in Harlem. Main article: March 1965 Main article: April 1965 March 2 – Vietnam War: Operation Rolling Thunder – The United States Air Force 2nd Air Division, United States Navy and South Vietnamese air force begin a 3½-year aerial bombardment campaign against North Vietnam. March 7 Mass in the Catholic Church worldwide is said in local languages (rather than Latin) for the first time.[5][6] "Bloody Sunday": Some 200 Alabama State Troopers attack 525 civil rights demonstrators in Selma, Alabama, as they attempt to march to the state capitol of Montgomery. March 8 – Vietnam War: Some 3,500 United States Marines arrive in Da Nang, South Vietnam, becoming the first American ground combat troops in Vietnam. March 9 – The "Turnaround Tuesday" march from Selma to Montgomery, Alabama, under the leadership of Martin Luther King Jr., stops at the site of "Bloody Sunday", to hold a prayer service and return to Selma, in obedience to a court restraining order. On the same day, White supremacists attack three white ministers, leaving Unitarian Universalist minister James J. Reeb in a coma. March 10 – An engagement is announced between Princess Margriet of the Netherlands and Pieter van Vollenhoven, who will become the first commoner and the first Dutchman to marry into the Dutch royal family. March 18 – Cosmonaut Alexei Leonov leaves his Voskhod 2 spacecraft for 12 minutes, becoming the first person to walk in space.[7] March 20 "Poupée de cire, poupée de son", sung by France Gall (music and lyrics by Serge Gainsbourg), wins the Eurovision Song Contest 1965 (staged in Naples) for Luxembourg.[8] The Indo-Pakistani War of 1965 begins. March 23 Events of March 23, 1965: Large student demonstration in Morocco, joined by discontented masses, meets with violent police and military repression. Gemini 3: NASA launches the United States' first 2-person crew (Gus Grissom, John Young) into Earth orbit. The first issue of The Vigilant is published from Khartoum. March 25 – Martin Luther King Jr. and 25,000 civil rights activists successfully end the 4-day march from Selma, Alabama, to the capitol in Montgomery. March 28 – At least 400 are killed or missing after an earthquake triggered a series of dam failures in La Ligua, Chile.[9] March 30 – The second ODECA charter, signed by Central American states on December 12, 1962, becomes effective. April 3 – The world's first space nuclear power reactor, SNAP-10A, is launched by the United States from Vandenberg AFB, California. The reactor operates for 43 days and remains in low Earth orbit. April 5 – At the 37th Academy Awards, My Fair Lady wins 8 Academy Awards, including Best Picture and Best Director. Rex Harrison wins an Oscar for Best Actor. Mary Poppins takes home 5 Oscars. Julie Andrews wins an Academy Award for Best Actress for her performance in the title role. Sherman Brothers receives 2 Oscars including Best Song, "Chim Chim Cher-ee". April 6 – The Intelsat I ("Early Bird") communications satellite is launched. It becomes operational May 2 and is placed in commercial service in June. April 9 – The West German parliament extends the statute of limitations on Nazi war crimes. April 12 – A historic and extremely destructive tornado outbreak struck the Midwest region of the United States, killing 266. April 18 – Consecration of Saint Clement of Ohrid Macedonian Orthodox Cathedral in Toronto, Canada. April 23 – The Pennine Way officially opens. April 24 The 1965 Yerevan demonstrations start in Yerevan, demanding recognition of the Armenian genocide. The bodies of Portuguese opposition politician Humberto Delgado and his secretary Arajaryr Moreira de Campos are found in a forest near Villanueva del Fresno, Spain (they were killed February 12). In the Dominican Republic, officers and civilians loyal to deposed President Juan Bosch mutiny against the right-wing junta running the country, setting up a provisional government. Forces loyal to the deposed military-imposed government stage a countercoup the next day, and civil war breaks out, although the new government retains its hold on power. April 26 – Rede Globo is founded in Rio de Janeiro, Brazil. April 28 U.S. troops occupy the Dominican Republic. Vietnam War: Prime Minister of Australia Robert Menzies announces that the country will substantially increase its number of troops in South Vietnam, supposedly at the request of the Saigon government (it is later revealed that Menzies had asked the leadership in Saigon to send the request at the behest of the Americans). April 29 – Australia announces that it is sending an infantry battalion to support the South Vietnam government. Main article: May 1965 Main article: June 1965 May 1 Bob Askin replaces Jack Renshaw as Premier of New South Wales. The Battle of Dong-Yin occurs as a conflict between Taiwan and the People's Republic of China. May 9 – Pianist Vladimir Horowitz returns to the stage after a 12-year absence, performing a legendary concert in Carnegie Hall in New York. May 12 –West Germany and Israel establish diplomatic relations. Muhammad Ali standing over Sonny Liston May 25 – Muhammad Ali knocks out Sonny Liston in the first round of their championship rematch with the "Phantom Punch" at the Central Maine Civic Center in Lewiston. May 27 – Internazionale beats Benfica 1–0 at the San Siro, Milan and wins the 1964–65 European Cup in Association football. May 29 – A mining accident in Dhanbad, India, kills 274. May 31 – Scottish racing driver Jim Clark wins the Indianapolis 500, later this year winning the Formula One world driving championship. June 1 – A coal mine explosion in Fukuoka, Japan, kills 237. June 2 – Vietnam War: The first contingent of Australian combat troops arrives in South Vietnam. June 7 – Kakanj mine disaster: A mining accident in Kakanj, Bosnia and Herzegovina, results in 128 deaths. June 10 – Vietnam War – Battle of Dong Xoai: About 1,500 Viet Cong mount a mortar attack on Đồng Xoài, overrunning its military headquarters and the adjoining militia compound. June 19 Houari Boumediene's Revolutionary Council ousts Ahmed Ben Bella, in a bloodless coup in Algeria. Air Marshal Nguyen Cao Ky, head of the South Vietnamese Air Force, was appointed prime minister at the head of the military junta, with General Nguyễn Văn Thiệu becoming a figurehead president, ending two years of short-lived military juntas.[10][non sequitur] June 20 – Police in Algiers break up demonstrations by people who have taken to the streets chanting slogans in support of deposed President Ahmed Ben Bella. June 22 – The Treaty on Basic Relations between Japan and the Republic of Korea is signed in Tokyo. June 25 – A U.S. Air Force Boeing C-135 Stratolifter bound for Okinawa crashes just after takeoff at MCAS El Toro in Orange County, California, killing all 85 on board. Main article: July 1965 Main article: August 1965 July – The Commonwealth secretariat is created. July 14 – U.S. spacecraft Mariner 4 flies by Mars, becoming the first spacecraft to return images from the Red Planet. July 15 – Greek Prime minister Georgios Papandreou and his government are dismissed by King Constantine II. July 16 – The Mont Blanc Tunnel, a highway tunnel between France and Italy, is inaugurated by presidents Giuseppe Saragat and Charles de Gaulle. July 24 – Vietnam War: Four F-4C Phantoms escorting a bombing raid at Kang Chi are targeted by antiaircraft missiles, in the first such attack against American planes in the war. One is shot down and the other 3 sustain damage. July 26 – The Maldives obtains full independence from Great Britain.[11] July 27 – Edward Heath becomes Leader of the British Conservative Party. July 28 – Vietnam War: U.S. President Lyndon B. Johnson announces his order to increase the number of United States troops in South Vietnam from 75,000 to 125,000, and to more than double the number of men drafted per month - from 17,000 to 35,000. July 30 – War on Poverty: U.S. President Lyndon B. Johnson signs the Social Security Act of 1965 into law, establishing Medicare and Medicaid. August 7 – Tunku Abdul Rahman, Prime Minister of Malaysia, recommends the expulsion of Singapore from the Federation of Malaysia following a deterioration of PAP–UMNO relations, negotiating its separation with Lee Kuan Yew, Prime Minister of Singapore. August 9 Proclamation of Singapore: Singapore is expelled from the Federation of Malaysia, which recognises it as a sovereign nation. Lee Kuan Yew announces Singapore's independence and assumes the position of Prime Minister of the new island nation – a position he holds until 1990. An explosion at an Arkansas missile plant kills 53. Indonesian president Sukarno collapses in public. August 11 – Racial rioting in the Los Angeles, California neighborhood of Watts breaks out after an African American motorist, Marquette Frye,[12] is stopped on suspicion of drunken driving. Six days of unrest are quelled by over 14,000 members of the California National Guard. There are 34 deaths and over $40 million in property damage. It is the largest and costliest urban rebellion of the Civil Rights movement.[13] August 18 – Vietnam War: Operation Starlite – 5,500 United States Marines destroy a Viet Cong stronghold on the Van Tuong peninsula in Quảng Ngãi Province, in the first major American ground battle of the war. The Marines were tipped off by a Viet Cong deserter who said that there was an attack planned against the U.S. base at Chu Lai. August 19 – At the conclusion of the Frankfurt Auschwitz trials, 66 ex-SS personnel receive life sentences, 15 others shorter ones. August 21 – NASA launches Gemini 5 (Gordon Cooper, Pete Conrad) on the first 1-week space flight, as well as the first test of fuel cells for electrical power on such a mission. August 30 – An avalanche buries a dam construction site at Saas-Fee, Switzerland, killing 90 workers. August 31 – U.S. President Johnson signs a law penalizing the burning of draft cards with up to 5 years in prison and a $1,000 fine. Main article: September 1965 Main article: October 1965 September 2 Pakistani troops enter the Indian sector of Kashmir, while Indian troops counter at Lahore. The People's Republic of China announces that it will reinforce its troops on the Indian border. Vietnam War: In a follow-up to August's Operation Starlite, United States Marines and South Vietnamese forces initiate Operation Piranha on the Batangan Peninsula, 23 miles (37 km) south of the Chu Lai Marine base. September 8 India opens 2 additional fronts against Pakistan. The Pakistan Navy destroys Indian Port of Dwarka. Operation Dwarka (Pakistan celebrates Victory Day annually). September 9 U.N. Secretary General U Thant negotiates with Pakistan President Ayub Khan. U Thant recommends China for United Nations membership. September 14 – The fourth and final period of the Second Vatican Council opens. September 16 – In Iraq, Prime Minister Arif Abd ar-Razzaq's attempted coup fails. September 17 – King Constantine II of Greece forms a new government with Prime Minister Stephanos Stephanopoulos, in an attempt to end a 2-year-old political crisis. September 18 In Denmark, Palle Sørensen shoots 4 policemen in pursuit; he is apprehended the same day. Comet Ikeya–Seki is first sighted by Japanese astronomers. Soviet Premier Alexei Kosygin invites the leaders of India and Pakistan to meet in the Soviet Union to negotiate. September 19 – Pakistani Forces achieve a decisive victory at the Battle of Chawinda, ultimately halting the Indian advance and successfully stabilizing the Sialkot Front, it is the world's largest tank battle since the Battle of Kursk in the Second World War between Nazi Germany and the Soviet Union September 20 – Vietnam War: An USAF F-104 Starfighter piloted by Captain Philip Eldon Smith is shot down by a Chinese MiG-19 Farmer. The pilot is held until March 15, 1973. September 21 – Gambia, Maldives and Singapore are admitted as members of the United Nations. September 22 – Radio Peking announces that Indian troops have dismantled their equipment on the Chinese side of the border. September 24 Fighting resumes between Indian and Pakistani troops. The British governor of Aden cancels the constitution and takes direct control of the protectorate, due to the bad security situation. September 27 – The largest tanker ship at this time, Tokyo Maru, is launched in Yokohama, Japan. September 28 Fidel Castro announces that anyone who wants to can emigrate to the United States. Taal Volcano in Luzon, Philippines, erupts, killing hundreds. September 30 The Indonesian army, led by General Suharto, crushes an alleged communist coup attempt (see Transition to the New Order and 30 September Movement). The classic family sci-fi show Thunderbirds debuts on ITV in the United Kingdom. October 3 – Fidel Castro announces that Che Guevara has resigned and left Cuba. October 4 At least 150 are killed when a commuter train derails at the outskirts of Durban, KwaZulu-Natal, South Africa. Prime minister Ian Smith of Rhodesia and Arthur Bottomley of the Commonwealth of Nations begin negotiations in London. Pope Paul VI makes the first papal visit to the United States. He appears for a Mass in Yankee Stadium and makes a speech at the United Nations. The University of California, Irvine opens its doors. October 5 – Pakistan severs diplomatic relations with Malaysia because of their disagreement in the UN. October 6 – Ian Brady, a 27-year-old stock clerk from Hyde in Cheshire, is arrested for allegedly hacking to death (with a hatchet) 17-year-old apprentice electrician Edward Evans at a house on the Hattersley housing estate. October 7 – Seven Japanese fishing boats are sunk off Guam by Super Typhoon Carmen; 209 are killed. October 8 Indonesian mass killings of 1965–1966: The Indonesian army instigates the arrest and execution of communists which last until next March.[14] The 7 Fundamental Principles of the Red Cross and Red Crescent are adopted at the XX International

Conference in Vienna, Austria. The International Olympic Committee admits East Germany as a member. October 10 – The first group of Cuban refugees travels to the U.S. October 12 Per Borten forms a government in Norway. The U.N. General Council recommends that the United Kingdom try everything to stop a rebellion in Rhodesia. October 13 – Congo President Joseph Kasavubu fires Prime Minister Moise Tshombe and forms a provisional government, with Evariste Kimba in a leading position. October 15 – Vietnam War: The Catholic Worker Movement stages an anti-war protest in Manhattan. One draft card burner is arrested, the first under the new law. October 17 – The New York World's Fair at Flushing Meadows, closes. Due to financial losses, some of the projected site park improvements fail to materialize. October 18 – The Indonesian government outlaws the Communist Party of Indonesia.[15] October 20 – Ludwig Erhard is re-elected Chancellor of West Germany (he had first been elected in 1963). October 21 Comet Ikeya–Seki approaches perihelion, passing 450,000 kilometres (280,000 mi) from the sun. The Organization of African Unity meets in Accra, Ghana. October 22 African countries demand that the United Kingdom use force to prevent Rhodesia from declaring unilateral independence. Colonel Christophe Soglo stages a second coup in Dahomey. October 25 – The Soviet Union declares its support of African countries in case Rhodesia unilaterally declares independence. October 27 Brazilian president Humberto de Alencar Castelo Branco removes power from parliament, legal courts and opposition parties. Süleyman Demirel of AP forms the new government of Turkey (30th government). October 28 – Pope Paul VI promulgates Nostra aetate, a "Declaration on the Relation of the (Roman Catholic) Church with Non-Christian Religions" by the Second Vatican Council which includes a statement that Jews are not collectively responsible for the death of Jesus (Jewish deicide). October 29 – An 80-kiloton nuclear device is detonated at Amchitka Island, Alaska, as part of the Vela Uniform program, code-named Project Long Shot. October 30 – Vietnam War: Near Da Nang, United States Marines repel an intense attack by Viet Cong forces, killing 56 guerrillas. A sketch of Marine positions is found on the dead body of a 13-year-old Vietnamese boy who sold drinks to the Marines the day before. Main article: November 1965 Main article: December 1965 November 1 – A trolleybus plunges into the Nile at Cairo, Egypt, killing 74 passengers. November 3 – French President Charles de Gaulle announces (just short of his 75th birthday) that he will stand for re-election. November 5 – Martial law is announced in Rhodesia. The United Nations General Assembly accepts British intent to use force against Rhodesia if necessary by a vote of 82–9. November 6 – Freedom Flights begin: Cuba and the United States formally agree to start an airlift for Cubans who want to go to the United States (by 1971, 250,000 Cubans take advantage of this program). November 8 – Vietnam War – Operation Hump: The United States Army 173rd Airborne is ambushed by over 1,200 Viet Cong. November 11 In Rhodesia (modern-day Zimbabwe), the white-minority government of Ian Smith unilaterally declares de facto independence (UDI). United Airlines Flight 227 crashes short of the runway and catches fire at Salt Lake City International Airport, killing 43 out of 91 passengers and crew. November 12 – A UN Security Council resolution (voted 10–0) recommends that other countries not recognize independent Rhodesia. November 13 The SS Yarmouth Castle burns and sinks 60 miles (97 km) off Nassau, Bahamas, with the loss of 90 lives. British theatre critic Kenneth Tynan says "fuck" during a discussion on BBC satirical programme BBC-3 for what many believe was the first time on British television. The corporation later issues a public apology. November 14 – Vietnam War – Battle of Ia Drang: In the Ia Drang Valley of the Central Highlands in Vietnam, the first major engagement of the war between regular United States and North Vietnamese forces begins. November 15 – U.S. racer Craig Breedlove sets a new land speed record of 600.601 mph (966.574 km/h). November 16 – Venera program: The Soviet Union launches the Venera 3 space probe from Baikonur, Kazakhstan toward Venus (on March 1, 1966, it becomes the first spacecraft to reach the surface of another planet). November 20 – The United Nations Security Council recommends that all states stop trading with Rhodesia. November 22 – The United Nations Development Programme (UNDP) is established as a specialized agency of the United Nations. November 23 – Soviet general Mikhail Kazakov assumes command of the Warsaw Pact. November 24 – Congolese lieutenant general Joseph Mobutu ousts Joseph Kasavubu and declares himself president. November 26 – At the Hammaguir launch facility in the Sahara Desert, France launches a Diamant A rocket with its first satellite, Astérix-1 on board, becoming the third country to enter outer space. November 27 Tens of thousands of Vietnam War protesters picket the White House, then march on the Washington Monument. Vietnam War: The Pentagon tells U.S. President Lyndon B. Johnson that if planned major sweep operations to neutralize Viet Cong forces during the next year are to succeed, the number of American troops in Vietnam will have to be increased from 120,000 to 400,000. November 28 – Vietnam War: In response to U.S. President Lyndon B. Johnson's call for "more flags" in Vietnam, Philippines President-elect Ferdinand Marcos announces he will send troops to help fight in South Vietnam. November 29 – The Canadian satellite Alouette 2 is launched. December 5 Charles de Gaulle is re-elected as French president with 10,828,421 votes. The "Glasnost Meeting" in Moscow becomes the first spontaneous political demonstration in the Soviet Union, and the first demonstration for civil rights in the Soviet Union. December 8: End of the Second Vatican Council December 8 The Second Vatican Council closes. Rhodesian prime minister Ian Smith warns that Rhodesia will resist a trade embargo by neighbouring countries with force. The Race Relations Act becomes the first legislation to address racial discrimination in the UK. December 9 – A Charlie Brown Christmas, the first Peanuts television special, debuts on CBS in the United States. It becomes a Christmas tradition. December 15 The Caribbean Free Trade Association (CARIFTA) is formed. Gemini 6 and Gemini 7 perform the first controlled rendezvous in Earth orbit. December 20 – The World Food Programme is made a permanent agency of the United Nations. December 21 The Soviet Union announces that it has shipped rockets to North Vietnam. In West Germany, Konrad Adenauer resigns as chairman of the Christian Democratic Party. The United Nations adopts the International Convention on the Elimination of All Forms of Racial Discrimination. A new 1-hour German-American production of the ballet The Nutcracker, with an international cast that includes Edward Villella in the title role, makes its U.S. television debut. It is repeated annually by CBS over the next 3 years but after that is virtually forgotten until issued on DVD in 2009 by Warner Archive. December 22 – A military coup is launched in Dahomey. December 25 – The Yemeni Nasserist Unionist People's Organisation is founded in Ta'izz. December 30: Ferdinand Marcos is the 10th President of the Philippines December 30 Ferdinand Marcos becomes President of the Philippines. President Kenneth Kaunda of Zambia announces that Zambia and the United Kingdom have agreed on a deadline before which the Rhodesian white government should be brought down. December 31 – Bokassa takes power in the Central African Republic. Aborigines are given the vote in Queensland, Australia. Hainzl Industriesysteme GmbH company is founded in Austria.[16] Tokyo officially becomes the largest city of the world, taking the lead from New York City.[17] World population 1965 1960 1970 World 3,334,874,000 3,021,475,000 313,399,000 3,692,492,000 357,618,000 Africa 313,744,000 277,398,000 36,346,000 357,283,000 43,539,000 Asia 1,899,424,000 1,701,336,000 198,088,000 2,143,118,000 243,694,000 Europe 634,026,000 604,401,000 29,625,000 655,855,000 21,829,000 Latin America 250,452,000 218,300,000 32,152,000 284,856,000 34,404,000 Northern America 219,570,000 204,152,000 15,418,000 231,937,000 12,367,000 Oceania 17,657,000 15,888,000 1,769,000 19,443,000 1,786,000 Julia Ormond Vinnie Jones Joely Richardson Diane Lane January 4 Julia Ormond, British actress[18] Yvan Attal, Israeli-born French actor and director January 5 Vinnie Jones, British actor[19] Patrik Sjöberg, Swedish high jumper[20] January 9 Haddaway, German singer Farah Khan, Indian choreographer, film director Joely Richardson, British actress January 10 – Butch Hartman, American animator and voice actor January 12 Nikolai Borschevsky, Russian ice hockey player Maybrit Illner, German television journalist and presenter Rob Zombie, American musician January 14 Shamil Basayev, Chechen terrorist (d. 2006) Marc Delissen, Dutch field hockey player Bob Essensa, Canadian ice hockey player January 15 Adam Jones, American musician, guitarist of metal band Tool James Nesbitt, Northern Irish actor[21] January 20 – Sophie, Duchess of Edinburgh, wife of Prince Edward, Duke of Edinburgh January 21 – Jam Master Jay, American DJ, rapper and producer (d. 2002) January 22 DJ Jazzy Jeff, American disc jockey Diane Lane, American actress January 23 – Catherine Guilloux, French businesswoman January 24 – Porfirio Fisac, Spanish basketball coach January 25 – Esa Tikkanen, Finnish ice hockey player January 26 – Natalya Turchenko, Soviet artistic gymnast January 27 Alan Cumming, Scottish actor Ignacio Noé, Argentine artist January 29 Dominik Hašek, Czech hockey player January 31 Kim Nam-jin, South Korean actor Charles Rock Adam Burrow Michael Bay Dr. Dre February 1 Dave Callaghan, South African cricketer Brandon Lee, Chinese-American actor (d. 1993) Sherilyn Fenn, American actress Princess Stéphanie of Monaco February 3 – Maura Tierney, American actress February 5 – Gheorghe Hagi, Romanian footballer, manager and club owner[22] February 7 – Chris Rock, African-American actor, comedian, and film director February 8 – Dicky Cheung, Hong Kong actor February 11 – Roberto Moya, Cuban athlete (d. 2020) February 12 – Brett Kavanaugh, American attorney and Supreme Court Justice February 15 – Héctor Beltrán Leyva, Mexican drug lord (d. 2018) February 16 – Adama Barrow, Gambian politician, 3rd President of Gambia February 17 – Michael Bay, American film director[23] February 18 – Dr. Dre, African-American rapper and music producer February 23 Kristin Davis, American actress[24] Michael Dell, American computer manufacturer[25] Vincent Chalvon-Demersay, French producer Helena Suková, Czech tennis player[26] February 25 – Sylvie Guillem, French ballerina February 27 – Claudia Zobel, Filipina actress (d. 1984) February 28 – Park Gok-ji, South Korean film editor Aamir Khan Mark Carney Rick Harrison The Undertaker Sarah Jessica Parker March 1 Mike Dean, Record producer Stewart Elliott, Canadian jockey Lu Tai, Taiwanese-Canadian cardiologist (d. 2018) March 2 – Ami Bera, American politician[27] March 3 Tedros Adhanom, Director of the World Health Organization March 4 Greg Alexander, Australian rugby league player Paul W. S. Anderson, British filmmaker, producer and screenwriter March 5 – Harry Bevers, Dutch politician March 8 Mac Jack, South African educator and politician (d. 2020) March 8 – Caio Júnior, Brazilian football forward and manager (d. 2016) March 9 – Antonio Saca, 43rd President of El Salvador March 11 Catherine Fulop, Venezuelan actress, model, beauty pageant contestant, and television presenter Jesse Jackson Jr., African-American politician Laurence Llewelyn-Bowen, British designer and television presenter March 14 – Aamir Khan, Indian film director, producer, film and scriptwriter and actor March 16 Utut Adianto, Indonesian chess grandmaster and politician Mark Carney, Canadian economist and politician, 24th Prime Minister of Canada[28] March 22 – Rick Harrison, American businessman and reality television personality March 23 – Marti Pellow, Scottish singer (Wet Wet Wet) March 24 Rob MacCachren, American racecar driver The Undertaker, American professional wrestler March 25 Stefka Kostadinova, Bulgarian high jumper and president of the Bulgarian Olympic Committee Sarah Jessica Parker, American actress March 26 – Prakash Raj, Indian actor, producer and director March 29 – Voula Patoulidou, Greek athlete March 30 – Piers Morgan, British journalist and television personality Robert Downey Jr. Martin Lawrence Leni Robredo Kevin James April 1 Brian Marshall, Canadian retired track and field athlete Bekir Bozdağ, Turkish theologian, lawyer, and politician April 3 – Nazia Hassan, Pakistani pop singer-songwriter, lawyer and social activist (d. 2000) April 4 – Robert Downey Jr., American actor, producer, and singer April 6 Black Francis, American musician Rica Reinisch, German swimmer April 9 – Paulina Porizkova, Swedish-American model and actress April 10 Anna-Leena Härkönen, Finnish author[29] Jure Robič, Slovenian cyclist (d. 2010) April 11 – Eelco van Asperen, Dutch computer scientist April 12 – Kim Bodnia, Danish actor and director April 15 – Linda Perry, American musician April 16 – Martin Lawrence, American actor, comedian, and producer April 18 – Camille Coduri, English actress April 19 – Suge Knight, American record producer and convicted felon April 20 – Jovy Marcelo, Filipino racing driver (d. 1992) April 21 – Julio Robaina, Republican politician, Mayor of Hialeah, Florida April 23 – Leni Robredo, 14th Vice President of the Philippines April 24 – Michel Leclerc, French director and screenwriter April 25 – Édouard Ferrand, French politician (d. 2018) April 26 – Kevin James, American comedian and actor April 27 – Edwin Poots, Irish politician April 29 – David Shafer, American politician, Georgia April 30 – Adrian Pasdar, Iranian-American actor and voice artist Trent Reznor John C. Reilly Yahya Jammeh Brooke Shields May 2 – Myriam Hernández, Chilean singer May 3 Gary Mitchell, Irish playwright Rob Brydon, Welsh actor, comedian, impressionist and presenter May 7 Owen Hart, Canadian professional wrestler (d. 1999)[30] Norman Whiteside, Northern Irish football player May 9 – Steve Yzerman, Canadian hockey player May 10 – Linda Evangelista, Canadian supermodel May 11 – Monsour del Rosario, Filipino Olympic athlete and actor May 12 – Renée Simonsen, Danish model and writer May 13 – José Antonio Delgado, Venezuelan mountain climber (d. 2006) May 14 – Eoin Colfer, Irish novelist May 16 Rodica Dunca, Romanian artistic gymnast Krist Novoselic, American musician and activist (Nirvana) May 17 – Trent Reznor, American rock musician (Nine Inch Nails) May 19 – Philippe Dhondt, French singer May 23 Melissa McBride, American actress (The Walking Dead) May 24 Carlos Franco, Paraguayan golfer John C. Reilly, American actor and comedian Shinichirō Watanabe, Japanese anime director May 25 – Yahya Jammeh, President of the Gambia May 29 – Emilio Sánchez, Spanish tennis player May 30 – Guadalupe Grande, Spanish poet (d. 2021) May 31 – Brooke Shields, American actress and model Mick Foley Frank Grillo Elizabeth Hurley Kim Dickens June 1 Larisa Lazutina, Russian cross-country skier Nigel Short, English chess player June 2 – Steve and Mark Waugh, Australian cricketers June 4 Mick Doohan, Australian motorcycle racer Andrea Jaeger, American tennis player[31] June 6 Cam Neely, Canadian ice hockey player Megumi Ogata, Japanese voice actress and singer[32] June 7 Mick Foley, American professional wrestler Damien Hirst, British artist Christine Roque, French singer June 8 Frank Grillo, American actor[33] Rob Pilatus, German model, dancer and singer (d. 1998) June 10 Veronica Ferres, German actress Elizabeth Hurley, English model and actress June 11 – Manuel Uribe, morbidly obese Mexican (d. 2014) June 12 – Carlos Luis Morales, Ecuadorian journalist (d. 2020) June 13 – Infanta Cristina of Spain, Spanish princess June 15 – Bernard Hopkins, American boxer June 16 – Andrea M. Ghez, American astronomer, recipient of the Nobel Prize in Physics[34] June 17 Dana Eskelson, American actress[35] Dan Jansen, American speedskater Dara O'Kearney, Irish ultra runner and professional poker player June 18 Kim Dickens, American actress Hani Mohsin, Malaysian celebrity, actor and host (d. 2006) June 21 Yang Liwei, Chinese major general, military pilot and China National Space Administration astronaut Gabriella Selmeczi, Hungarian jurist and politician Tim Lajcik, Czech American mixed martial artist, stuntman, actor and writer June 22 – Anubhav Sinha, Indian film director June 23 – Paul Arthurs, English Musician (Oasis) June 24 – Son Hyun-joo, South Korean actor June 25 – Jean Castex, French politician June 26 – Jana Hybášková, Czech politician and diplomat June 27 Frédéric Lemoine, French businessman S. Manikavasagam, Malaysian politician June 28 – Belayneh Dinsamo, Ethiopian long-distance runner June 29 Véronique Laury, French businesswoman Dado Villa-Lobos, Brazilian musician Matthew Weiner, American television writer, director and producer[36] June 30 Philippe Duquesne, French actor Cho Jae-hyun, South Korean actor Mitch Richmond, American basketball player Connie Nielsen Hailemariam Desalegn Shawn Michaels Slash Illeana Douglas Jeremy Piven J. K. Rowling July 1 Teddy McCarthy, hurler and Gaelic footballer Carl Fogarty, English motorcycle racer Mohammed Abdul Hussein, Iraqi former footballer Ramdas Ambatkar, Indian politician, Maharashtra MLC (d. 2025)[37] July 2 – Fredrik Sejersted, Norwegian jurist July 3 Komsan Pohkong, Thai lawyer Shinya Hashimoto, Japanese professional wrestler (d. 2005) Connie Nielsen, Danish actress Tommy Flanagan, Scottish actor July 4 – Tracy Letts, American actor, playwright and screenwriter July 5 Kathryn Erbe, American actress Eyran Katsenelenbogen, Israeli jazz pianist July 7 Paula Devicq, Canadian actress Jeremy Kyle, English radio and television presenter July 10 Danny Boffin, Belgian footballer Princess Alexia of Greece and Denmark Alec Mapa, American comedian July 11 – Ernesto Hoost, Dutch kickboxer July 12 – Mama Kandeh, Gambian politician July 13 – Akina Nakamori, Japanese singer and actress July 14 – Lou Savarese, American boxer July 15 – Dafna Rechter, Israeli actress and singer July 17 Santiago Segura, Spanish actor, screenwriter, producer and director Rosa Gumataotao Rios, 43rd Treasurer of the United States Alex Winter, British actor July 18 – Eva Ionesco, French actress, film director and screenwriter July 19 Dame Evelyn Glennie, Scottish virtuoso percussionist Hailemariam Desalegn, 15th Prime Minister of Ethiopia July 21 – Guðni Bergsson, Icelandic footballer July 22 – Shawn Michaels, American professional wrestler July 23 Grace Mugabe, First Lady of Zimbabwe Slash (Saul Hudson), English-born American rock guitarist July 25 – Illeana Douglas, American actress and producer[38] July 26 Vladimir Cruz, Cuban actor Jeremy Piven, American actor Jimmy Dore, American comedian and political commentator July 27 José Luis Chilavert, Paraguayan footballer[39] Trifon Ivanov, Bulgarian footballer (d. 2016)[40] July 28 – Daniela Mercury, Brazilian singer, songwriter, dancer, producer, actress and television host July 29 – Chang-Rae Lee, Korean-American novelist July 31 – J. K. Rowling, English author Sir Sam Mendes Viola Davis Kyra Sedgwick August 1 – Sam Mendes, English film director August 2 Sandra Ng, Hong Kong actress Hisanobu Watanabe, Japanese baseball player and coach August 4 Terri Lyne Carrington, American jazz drummer Dennis Lehane, American crime writer Fredrik Reinfeldt, Swedish Prime Minister[41] August 5 – Monica Ward, Italian actress and voice actress August 6 – David Robinson, American basketball player August 10 Claudia Christian, American actress, writer, singer, musician, and director Mike E. Smith, American jockey John Starks, American basketball player August 11 – Viola Davis, African-American actress August 15 – Vincent Kok, Hong Kong director and actor August 16 – Michael O'Gorman, American coxswain (d. 2018) August 19 Kevin Dillon, American actor Maria de Medeiros, Portuguese actress Kyra Sedgwick, American actress James Tomkins, Australian rower August 22 – David Reimer, Canadian man, born male but reassigned female and raised as a girl after a botched circumcision (d. 2004)[42] August 24 – Reggie Miller, American basketball player and commentator August 25 – Mia Zapata, American singer (d. 1993) August 26 – Azela Robinson, Mexican actress August 28 Satoshi Tajiri, Japanese video game designer and Pokémon creator[43] Amanda Tapping, Canadian actress Shania Twain, Canadian country singer and songwriter August 31 – Daniel Bernhardt, Swiss actor and martial artist Charlie Sheen Bashar al-Assad Dmitry Medvedev Kyle Chandler Tim Scott Petro Poroshenko September 1 – Craig McLachlan, Australian actor and singer September 2 – Lennox Lewis, British boxer September 3 Costas Mandylor, Greek-Australian actor Charlie Sheen, American actor and producer September 5 – Derby Makinka, Zambian footballer (d. 1993) September 6 – Gleisi Hoffmann, Brazilian lawyer and politician September 7 – Jörg Pilawa, German television presenter September 8 Tutilo Burger, German Benedictine monk and abbot Darlene Zschech, Australian singer and worship leader September 10 – Marco Pastors, Dutch politician September 11 Bashar al-Assad, President of Syria Moby, American musician September 12 Einstein Kristiansen, Norwegian cartoonist, designer, and television host September 14 – Dmitry Medvedev, former President of Russia September 15 – Fernanda Torres, Brazilian actress September 16 – Katy Kurtzman, American actress, director and producer September 17 Kyle Chandler, American actor Yuji Naka, Japanese video game programmer September 19 Goldie, English record producer and DJ Iliya Lazarov, Bulgarian politician Tim Scott, African-American politician and businessman Tshering Tobgay, former Prime Minister of Bhutan September 20 – Robert Rusler, American actor September 21 Cheryl Hines, American actress Johanna Vuoksenmaa, Finnish film director David Wenham, Australian actor Pramila Jayapal, American politician September 23 – Mark Woodforde, Australian tennis player September 25 – Scottie Pippen, American basketball player September 26 Radisav Ćurčić, Serbian-Israeli basketball player[44] Alexei Mordashov, Russian businessman Petro Poroshenko, former President of Ukraine September 27 – Steve Kerr, American basketball player Lennie James Steve Coogan October 1 – Andreas Keller, German field hockey player October 2 Gerardo Reyero, Mexican voice actor Ferhan and Ferzan Önder, Turkish-Austrian pianists[45][46] October 3 Adriana Calcanhotto, Brazilian singer and composer Jan-Ove Waldner, Swedish table tennis player[47] October 5 Mario Lemieux, Canadian ice hockey player Patrick Roy, Canadian ice hockey player October 6 – Steve Scalise, House Majority Whip and U.S. Representative of Louisiana's 1st district[48] October 8 Matt Biondi, American swimmer C. J. Ramone, American musician October 9 – Dionicio Cerón, Mexican long-distance runner October 10 – Chris Penn, American actor (d. 2006) October 11 Julianne McNamara, American artistic gymnast Lennie James, English actor, screenwriter, and playwright[49] October 13 – Kalpana, Indian film actress (d. 2016) October 14 Steve Coogan, British comedian and actor Jüri Jaanson, Estonian rower and politician October 16 – Kang Kyung-ok, South Korean artist October 17 Aravinda de Silva, Sri Lankan cricketer Rhys Muldoon, Australian actor, writer, and director October 18 – Zakir Naik, Indian doctor and Islamic activist October 19 The Renegade, American professional wrestler (d. 1999) Ty Pennington, American television presenter Tracy Griffith, American actress, sushi chef, and painter October 20 Amos Mansdorf, Israeli tennis player[50] Stefano Pioli, Italian football player and manager[51] October 22 – Sumito Estévez, Venezuelan chef[52] October 26 Aaron Kwok, Hong Kong singer and actor Kelly Rowan, Canadian actress Kenneth Rutherford, New Zealand cricketer October 29 – Christy Clark, Canadian politician October 30 – Zaza Urushadze, Georgian film director, producer and screenwriter (d. 2019) October 31 – Rob Rackstraw, British actor Shah Rukh Khan Björk Mads Mikkelsen Ben Stiller November 1 Patrik Ringborg, Swedish conductor November 2 Paweł Adamowicz, Polish politician and lawyer (d. 2019) Shah Rukh Khan, Indian actor, film/television producer and television presenter November 4 – Wayne Static, American singer and musician (Static-X) (d. 2014) November 7 – Sigrun Wodars, German athlete November 8 – Patricia Poleo, Venezuelan journalist[53] November 9 – Sir Bryn Terfel, Welsh baritone November 10 – Eddie Irvine, Northern Irish racing driver November 11 – Max Mutchnick, American television producer November 13 – Rick Roberts, Canadian actor November 17 – Pam Bondi, American attorney and politician, 87th U.S. Attorney General [54] November 19 Paulo Barreto, Brazilian cryptographer Laurent Blanc, French football player and manager November 20 – Yoshiki Hayashi, Japanese rock composer, pianist and drummer November 21 Björk, Icelandic singer-songwriter and musician Reggie Lewis, American basketball player (d. 1993) Alexander Siddig, Sudanese-British actor November 22 – Mads Mikkelsen, Danish actor November 23 – Radion Gataullin, Uzbek-Russian pole-vaulter November 24 – Shirley Henderson, Scottish actress November 25 – Ana Paula Padrão, Brazilian journalist, chief editor, entrepreneur, writer and television presenter November 26 – Scott Adsit, American actor November 29 Lauren Child, American author Raffaella Reggi, Italian tennis player[55] November 30 Ben Stiller, American actor, comedian and filmmaker Tashi Tenzing, Indian mountaineer Salman Khan Andrew Stanton Jeffrey Wright Andy Dick December 3 Steve Harris, American actor Katarina Witt, German figure skater Andrew Stanton, American animator, storyboard artist, film director, and screenwriter December 5 – Johnny Rzeznik, American rock singer and guitarist December 7 Teruyuki Kagawa, Japanese actor Jeffrey Wright, African-American actor December 8 – David Harewood, English actor December 9 – Brad Savage, American actor December 10 – Stephanie Morgenstern, Canadian actress December 15 – Luis Fabián Artime, Argentine footballer December 16 – J. B. Smoove, African-American actor and comedian December 18 – John Moshoeu, South African footballer (d. 2015)[56] December 19 – Jessica Steen, Canadian actress December 21 Andy Dick, American actor and comedian Anke Engelke, German comedian, actress and voice-over actress December 23 – Andreas Kappes, German cyclist (d. 2018) December 27 – Salman Khan, Indian actor, television presenter December 30 Valentina Legkostupova, Soviet and Russian pop singer, teacher and producer (d. 2020) Robert Rep, Dutch politician December 31 Nicholas Sparks, American author[57] Gong Li, Chinese actress Yklymberdi Paromov, Turkmen politician Marga Hoek, Dutch businesswoman T. S. Eliot Winston Churchill January 4 – T. S. Eliot, American-British poet, Nobel Prize laureate (b. 1888)[58] January 10 Antonín Bečvář, Czechoslovak astronomer (b. 1901) Frederick Fleet, British sailor and lookout aboard the RMS Titanic (b. 1887) January 12 – Lorraine Hansberry, African-American playwright and writer (b. 1930) January 14 – Jeanette MacDonald, American actress and singer (b. 1903) January 15 – Pierre Ngendandumwe, 4th and 6th Prime Minister of Burundi (assassinated) (b. 1930) January 20 – Alan Freed, American disc jockey (b. 1921) January 24 – Sir Winston Churchill, British politician and statesman, twice Prime Minister of the United Kingdom, World War II leader, recipient of the Nobel Prize in Literature (b. 1874)[59] January 27 – Hassan Ali Mansur, Iranian politician, 69th Prime Minister of Iran (b. 1923) January 28 Taimur bin Feisal, Sultan of Oman (b. 1886) Tich Freeman, English cricketer (b. 1888)[60] Maxime Weygand, French general (b. 1867) January 31 – Konstantin Muraviev, 31st Prime Minister of Bulgaria (b. 1893) Nat King Cole Malcolm X February 5 – Irving Bacon, American actor (b. 1893) February 6 – Frederick, Prince of Hohenzollern (b. 1891) February 7 – Nance O'Neil, American stage and film actress (b. 1874) February 9 – Khan Bahadur Ahsanullah, Indian educationist, philosopher, philanthropist, social reformer and spiritualist (b. 1874)[61] February 13 Humberto Delgado, Portuguese general and opposition politician (b. 1906) William Heard Kilpatrick, American mathematician and philosopher (b. 1871) February 14 – Désiré-Émile Inghelbrecht, French composer (b. 1880) February 15 – Nat King Cole, American singer and musician (b. 1919)[62] February 19 Forrest Taylor, American actor (b. 1883)[63] Tom Wilson, American actor (b. 1880) February 20 – Michał Waszyński, Polish film director and producer (b. 1904)[64] February 21 – Malcolm X, American civil rights activist (b. 1925)[65] February 22 – Felix Frankfurter, U.S. Supreme Court Justice (b. 1882) February 23 – Stan Laurel, British actor (b. 1890)[66] February 24 – Takeo Itō, Japanese general (b. 1889) February 28 – Adolf Schärf, Austrian politician, 6th President of Austria (b. 1890) King Farouk of Egypt Mary, Princess Royal and Countess of Harewood March 5 – Salvador Castaneda Castro, 31st President of El Salvador (b. 1888) March 6 Margaret Dumont, American actress (b. 1889) Herbert Morrison, British politician (b. 1888)[67] March 7 – Louise Mountbatten, queen consort of Sweden as second wife of King Gustaf VI Adolf (b. 1889) March 13 Corrado Gini, Italian statistician (b. 1884)[68] Vittorio Jano, Italian automobile designer (b. 1891)[69] Fan Noli, Albanian bishop, poet and politician, 13th Prime Minister of Albania (b. 1882) March 14 – Marion Jones Farquhar, American tennis champion (b. 1879) March 17 Nancy Cunard, English writer, heiress and political activist (b. 1896) Amos Alonzo Stagg, American baseball, basketball and football player and coach (b. 1862) March 18 – Farouk of Egypt, deposed king (b. 1920) March 19 – Gheorghe Gheorghiu-Dej, Romanian communist leader, 47th Prime Minister of Romania (b. 1901) March 22 – Fidel Dávila, Spanish general and minister (b. 1878) March 23 – Mae Murray, American silent film actress (b. 1885) March 25 – Viola Liuzzo, American Unitarian Universalist and civil rights activist (b. 1925) March 28 Mary, Princess Royal and Countess of Harewood, member of the British royal family (b. 1897) Jack Hoxie, American actor, rodeo performer (b. 1885) March 30 – Philip Showalter Hench, American physician, recipient of the Nobel Prize in Physiology or Medicine (b. 1896) Edward Victor Appleton April 3 – Ray Enright, American film director (b. 1896) April 9 – Sherman Minton, American politician and Associate Justice of the Supreme Court of the United States (b. 1890)[70] April 10 Linda Darnell, American actress (b. 1923) La Belle Otero, Spanish actress, dancer and courtesan (b. 1868) April 14 Leonard Mudie, English actor (b. 1883)[71] Perry Smith (b. 1928) and Richard Hickock (b. 1931), American convicted murderers April 16 – Sydney Chaplin, English actor (b. 1885) April 18 – Guillermo González Camarena, Mexican inventor (b. 1917) April 21 Sir Edward Victor Appleton, English physicist, Nobel Prize laureate (b. 1892) Pedro Albizu Campos, advocate of Puerto Rican independence (b. 1891)[72] April 23 – George Adamski, Polish-American UFO writer (b. 1891) April 24 – Louise Dresser, American actress (b. 1878) April 27 – Edward R. Murrow, American journalist (b. 1908)[73] April 30 – Helen Chandler, American actress (b. 1906) Leopold Figl May 1 – Spike Jones, American musician and bandleader (b. 1911) May 6 – Oren E. Long, American politician, 10th Governor of Hawai'i (b. 1889) May 7 Charles Sheeler, American photographer (b. 1883) Alf Bjørnskau Bastiansen, Norwegian priest and politician (b. 1883) May 9 – Leopold Figl, 14th Chancellor of Austria and acting President of Austria (b. 1902) May 10 – Hubertus van Mook, Dutch Governor-General of the Dutch East Indies (b. 1894)[74] May 14 – Frances Perkins, first woman appointed as a United States presidential cabinet member (Labor) (b. 1880) May 15 – Yisrael Bar-Yehuda, Zionist activist and Israel politician (b. 1895) May 18 – Eli Cohen, Israeli spy (b. 1924) May 19 – Maria Dąbrowska, Polish writer (b. 1889) May 21 – Sir Geoffrey de Havilland, British aviation pioneer and aircraft company founder (b. 1882)[75] May 23 Rosina Anselmi, Italian actress (b. 1880) David Smith, American sculptor (b. 1906) May 24 – Sonny Boy Williamson, American blues musician (b. 1899) May 27 – John Rinehart Blue, American military officer, educator, businessperson, and politician (b. 1905)[76] Martin Buber June 1 – Curly Lambeau, American football player and coach (b. 1898) June 5 Eleanor Farjeon, British author of children's literature (b. 1881) Prince Wilhelm, Duke of Södermanland (b. 1884) June 7 – Judy Holliday, American actress, comedian, and singer (b. 1921) June 11 – José Mendes Cabeçadas, Portuguese navy officer, 94th Prime Minister of Portugal and 9th President of Portugal (b. 1883) June 13 – Martin Buber, Austrian-Israeli philosopher (b. 1878) June 15 – Steve Cochran, American actor (b. 1917) June 19 – James Collip, Canadian biochemist (b. 1892) June 20 – Bernard Baruch, American financier and presidential adviser (b. 1870) June 22 – David O. Selznick, American film producer (b. 1902) June 23 – Mary Boland, American actress (b. 1882) June 28 – Red Nichols, American jazz cornettist (b. 1905) June 30 – Bessie Barriscale, American actress (b. 1884) Syngman Rhee July 1 – Wally Hammond, English cricketer (b. 1903) July 7 – Moshe Sharett, 2nd Prime Minister of Israel (b. 1894) July 8 – T. S. Stribling, American novelist (b. 1881)[77] July 11 – Ray Collins, American actor (b. 1889) July 13 – Laureano Gómez, 43rd President of Colombia (b. 1889) July 14 Adlai Stevenson II, American politician (b. 1900) Max Woosnam, English sportsman (b. 1892) July 19 Clyde Beatty, American animal trainer (b. 1903) Ingrid Jonker, South African Afrikaans poet (b. 1933) Syngman Rhee, Korean statesman, 1st President of South Korea (b. 1875) July 24 – Constance Bennett, American actress (b. 1904) July 28 – Rampo Edogawa, Japanese author and critic (b. 1894) July 30 Pier Ruggero Piccio, Italian World War I fighter ace, air force general (b. 1880)[78] Jun'ichirō Tanizaki, Japanese writer (b. 1886) Le Corbusier August 1 – John Miller, American Olympic rower - Men's eights (b. 1903) August 6 Nancy Carroll, American actress (b. 1903) Everett Sloane, American actor (b. 1909) August 8 – Shirley Jackson, American author (b. 1916) August 9 – Creighton Hale, American actor (b. 1882) August 13 – Hayato Ikeda, Japanese politician, 38th Prime Minister of Japan (b. 1899) August 25 – Johnny Hayes, American Olympic athlete (b. 1886) August 27 – Le Corbusier, Swiss architect (b. 1887) August 28 Rashid Ali al-Gaylani, Iraqi politician, 9th Prime Minister of Iraq (b. 1892) Giulio Racah, Israeli physicist (b. 1909) August 29 – Paul Waner, American baseball player (b. 1903) Yunus Hussain Dorothy Dandridge September 4 Tommy Hampson, British Olympic athlete (b. 1907) Albert Schweitzer, Alsatian physician and missionary, recipient of the Nobel Peace Prize (b. 1875) September 6 – Yunus Hussain, Pakistani fighter pilot (b. 1935) September 8 Dorothy Dandridge, American actress (b. 1922) Hermann Staudinger, German chemist, Nobel Prize laureate (b. 1881) September 12 – Lucian Truscott, American general (b. 1895) September 16 – Fred Quimby, American animated film producer (b. 1886) September 17 – Alejandro Casona, Spanish poet and playwright (b. 1903) September 22 – Othmar Ammann, Swiss-born American engineer (b. 1879)[79] September 27 – Clara Bow, American silent film actress (b. 1905) Samir Al-Rifai Paul Hermann Müller October 1 – Anton Boisen, American founder of the clinical pastoral education movement (b. 1876)[80] October 3 – Zachary Scott, American actor (b. 1914) October 8 – Thomas B. Costain, Canadian author and journalist (b. 1885)[81] October 11 Dorothea Lange, American photographer (b. 1895) Walther Stampfli, member of the Swiss Federal Council (b. 1884) October 12 – Samir Al-Rifai, 6-time Prime Minister of Jordan (b. 1901) October 13 – Paul Hermann Müller, Swiss chemist, recipient of the Nobel Prize in Physiology or Medicine (b. 1899) October 14 – Randall Jarrell, American poet (b. 1914) October 15 – Abraham Fraenkel, Israeli mathematician and recipient of the Israel Prize (b. 1891) October 17 – Bart King, American cricketer (b. 1873)[82] October 18 Oscar Beregi, Hungarian actor (b. 1876) Henry Travers, English actor (b. 1874) October 21 Bill Black, American musician and bandleader (b. 1926) Marie McDonald, American actress (b. 1923) October 22 – Paul Tillich, German American Christian existentialist philosopher and theologian (b. 1886) October 23 – Luis de la Puente Uceda, Peruvian guerrilla leader (b. 1926) October 24 – Hans Meerwein, German chemist (b. 1879) October 26 – Sylvia Likens, American murder victim (b. 1949) October 29 – Miller Anderson, American Olympic diver (b. 1922) October 30 – Arthur Schlesinger, Sr., American historian (b. 1888)[83] October 31 – Rita Johnson, American actress (b. 1913) Henry A. Wallace Emir Abdullah III Al-Salim Al-Sabah November 2 Félix Paiva, 28th President of Paraguay (b. 1877) H.V. Evatt, Australian politician, judge (b. 1894) November 6 Edgard Varèse, French-born American composer (b. 1883) Clarence Williams, American musician (b. 1893) November 8 Dorothy Kilgallen, American newspaper columnist and television personality (b. 1913) Emma Gramatica, Italian actress (b. 1874) Mirza Basheer-ud-Din Mahmood Ahmad, second caliph (b. 1889) November 12 – Taher Saifuddin, Indian Bohra spiritual leader (b. 1888)[84] November 16 Harry Blackstone Sr., American magician and illusionist (b. 1885)[85] W. T. Cosgrave, Irish politician, president of the Provisional Government and the Executive Council of the Irish Free State (b. 1880) November 18 Khalid al-Azm, 5-time Prime Minister of Syria and acting President of Syria (b. 1903) Henry A. Wallace, 33rd Vice President of the United States (b. 1888) November 24 – Abdullah III Al-Salim Al-Sabah, Emir of Kuwait (b. 1895) November 25 – Dame Myra Hess, English pianist (b. 1890) Somerset Maugham December 5 – Joseph Erlanger, American physiologist and academic, Nobel Prize laureate (b. 1874) December 9 – Branch Rickey, American baseball executive (b. 1881) December 10 – Henry Cowell, American composer (b. 1897) December 11 – George Constantinescu, Romanian scientist (b. 1881) December 15 – Joseph Bamina, 8th Prime Minister of Burundi (executed) (b. 1927) December 16 W. Somerset Maugham, English writer (b. 1874) Tito Schipa, Italian tenor (b. 1889) Queen Sālote Tupou III of Tonga, (b. 1900)[86] December 24 – William M. Branham, American minister (b. 1909) December 27 – Edgar Ende, German painter (b. 1901) December 29 – Kosaku Yamada, Japanese composer and conductor (b. 1886) Physics – Shin'ichirō Tomonaga, Julian Schwinger, Richard P. 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An 1835 illustration of power loom weaving, as part of the Industrial Revolution Millennia 2nd millennium Centuries 18th century 19th century 20th century Timelines 18th century 19th century 20th century State leaders 18th century 19th century 20th century Decades 1800s 1810s 1820s 1830s 1840s 1850s 1860s 1870s 1880s 1890s Categories: Births – Deaths Establishments – Disestablishments vte The 19th century began on 1 January 1801 (represented by the Roman numerals MDCCCI), and ended on 31 December 1900 (MCM). It was the 9th century of the 2nd millennium. It was characterized by vast social upheaval. Slavery was abolished in much of Europe and the Americas. The First Industrial Revolution, though it began in the late 18th century, expanded beyond its British homeland for the first time during the 19th century, particularly remaking the economies and societies of the Low Countries, France, the Rhineland, Northern Italy, and the Northeastern United States. A few decades later, the Second Industrial Revolution led to ever more massive urbanization and much higher levels of productivity, profit, and prosperity, a pattern that continued into the 20th century. The Catholic Church, in response to the growing influence and power of modernism, secularism and materialism, formed the First Vatican Council in the late 19th century to deal with such problems and confirm certain Catholic doctrines as dogma. Religious missionaries were sent from the Americas and Europe to Asia, Africa and the Middle East. In the Middle East, it was an era of change and reform. The Islamic gunpowder empires fell into decline and European imperialism brought much of South Asia, Southeast Asia, and almost all of Africa under colonial rule. Reformers were opposed at every turn by conservatives who strove to maintain the centuries-old Islamic laws and social order.[1] The 19th century also saw the collapse of the large Spanish, Portuguese, French and Mughal empires, which paved the way for the growing influence of the British, French, German, Russian, Austro-Hungarian, Italian, and Japanese empires along with the United States. Following the defeat of France in the Napoleonic Wars, it marked the end of France's status as the world superpower. Britain took France's status as the world superpower, the British and Russian empires expanded considerably, becoming two of the world's leading powers. Russia expanded its territory to the Caucasus and Central Asia. The Ottoman Empire underwent a period of Westernization and reform known as the Tanzimat, vastly increasing its control over core territories in the Middle East. However, it remained in decline and became known as the sick man of Europe, losing territory in the Balkans and North Africa. The remaining powers in the Indian subcontinent, such as the Maratha and Sikh empires, suffered a massive decline, and their dissatisfaction with the British East India Company's rule led to the Indian Rebellion of 1857 and the company's dissolution. India was later ruled directly by the British Crown through the establishment of the British Raj. During the post-Napoleonic era (after 1815), Britain enforced what became known as the Pax Britannica, which ushered in unprecedented globalization on a massive scale. Britain's overseas possessions grew rapidly in the first half of the century, especially with the expansion of vast territories in Canada, Australia, India, and in the last two decades of the century in Africa. By the end of the 19th century, the British controlled a fifth of the world's land and a quarter of the world's population. By the end of the century, Britain, France, Germany, and the United States had colonized almost all of Oceania. In East Asia, China under the Qing dynasty endured its century of humiliation by foreign powers that lasted until the first half of the 20th century. The last surviving man and woman, respectively, verified to have been born in the 19th century were Jiroemon Kimura (1897–2013) and Nabi Tajima (1900–2018), both Japanese. Official portrait of Queen Victoria, 1859 The first electronics appeared in the 19th century, with the introduction of the electric relay in 1835, the telegraph and its Morse code protocol in 1837, the first telephone call in 1876,[2] and the first functional light bulb in 1878.[3] The 19th century was an era of rapidly accelerating scientific discovery and invention, with significant developments in the fields of mathematics, physics, chemistry, biology, electricity, and metallurgy that laid the groundwork for the technological advances of the 20th century.[4] The Industrial Revolution began in Great Britain and spread to continental Europe, North America, and Japan.[5] The Victorian era was notorious for the employment of young children in factories and mines, as well as strict social norms regarding modesty and gender roles.[6] Japan embarked on a program of rapid modernization following the Meiji Restoration, before defeating China, under the Qing dynasty, in the First Sino-Japanese War. Advances in medicine and the understanding of human anatomy and disease prevention took place in the 19th century, and were partly responsible for rapidly accelerating population growth in the Western world. Europe's population doubled during the 19th century, from approximately 200 million to more than 400 million.[7] The introduction of railroads provided the first major advancement in land transportation for centuries, changing the way people lived and obtained goods, and fuelling major urbanization movements in countries across the globe. Numerous cities worldwide surpassed populations of a million or more during this century. London became the world's largest city and capital of the British Empire. Its population increased from 1 million in 1800 to 6.7 million a century later. The last remaining undiscovered landmasses of Earth, including vast expanses of interior Africa and Asia, were explored during this century, and with the exception of the extreme zones of the Arctic and Antarctic, accurate and detailed maps of the globe were available by the 1890s. Liberalism became the pre-eminent reform movement in Europe.[8] Arab slave traders and their captives along the Ruvuma River, 19th century Slavery was greatly reduced around the world. Following a successful slave revolt in Haiti, Britain and France stepped up the battle against the Barbary pirates and succeeded in stopping their enslavement of Europeans. The UK's Slavery Abolition Act 1833 charged the British Royal Navy with ending the global slave trade.[9] The first colonial empire in the century to abolish slavery was the British, who did so in 1834. America's Thirteenth Amendment following their Civil War abolished slavery there in 1865, and in Brazil slavery was abolished in 1888 (see abolitionism). Similarly, serfdom was abolished in Russia in 1861. The 19th century was remarkable in the widespread formation of new settlement foundations which were particularly prevalent across North America and Australia, with a significant proportion of the two continents' largest cities being founded at some point in the century. Chicago in the United States and Melbourne in Australia were non-existent in the earliest decades but grew to become the 2nd largest cities in the United States and British Empire respectively by the end of the century. In the 19th century, approximately 70 million people left Europe, with most migrating to the United States.[10] The 19th century also saw the rapid creation, development, and codification of many sports, particularly in Britain and the United States. Association football, rugby union, baseball, and many other sports were developed during the 19th century, while the British Empire facilitated the rapid spread of sports such as cricket to many different parts of the world. Also, women's fashion was a very sensitive topic during this time, as women showing their ankles was viewed to be scandalous. The boundaries set by the Congress of Vienna, 1815 It also marks the fall of the Ottoman rule of the Balkans which led to the creation of Serbia, Bulgaria, Montenegro, and Romania as a result of the second Russo-Turkish War, which in itself followed the great Crimean War. Map of the world from 1897. The British Empire (marked in pink) was the superpower of the 19th century. Industrial Revolution European imperialism British Regency, Victorian era (UK, British Empire) Bourbon Restoration, July Monarchy, French Second Republic, Second French Empire, French Third Republic (France) Risorgimento (Italy) Belle Époque (Europe) Edo period, Meiji period (Japan) Qing dynasty (China) Nguyen dynasty (Vietnam) Joseon dynasty (Korea) Zulu Kingdom (South Africa) Tanzimat, First Constitutional Era (Ottoman Empire) Russian Empire Manifest destiny, Antebellum era, Reconstruction era, American frontier, Gilded Age (United States) Main article: Napoleonic Wars For a chronological guide, see Timeline of the Napoleonic era. Napoleon's retreat from Russia in 1812. The war is turning decisively against the French Empire. The Napoleonic Wars were a series of major conflicts from 1803 to 1815 pitting the French Empire and its allies, led by Napoleon I, against a fluctuating array of European powers formed into various coalitions, financed and usually led by the United Kingdom. The wars stemmed from the unresolved disputes associated with the French Revolution and its resultant conflict. In the aftermath of the French Revolution, Napoleon Bonaparte gained power in France in 1799. In 1804, he crowned himself Emperor of the French. In 1805, the French victory over an Austrian-Russian army at the Battle of Austerlitz ended the War of the Third Coalition. As a result of the Treaty of Pressburg, the Holy Roman Empire was dissolved. Later efforts were less successful. In the Peninsular War, France unsuccessfully attempted to establish Joseph Bonaparte as King of Spain. In 1812, the French invasion of Russia had massive French casualties, and was a turning point in the Napoleonic Wars. Napoleon Bonaparte, Emperor of the First French Empire In 1814, after defeat in the War of the Sixth Coalition, Napoleon abdicated and was exiled to Elba. Later that year he escaped exile and began the Hundred Days before finally being defeated at the Battle of Waterloo and exiled to Saint Helena, an island in the South Atlantic Ocean. After Napoleon's defeat, the Congress of Vienna was held to determine new national borders. The Concert of Europe attempted to preserve this settlement was established to preserve these borders, with limited impact. Main article: Spanish American wars of independence The Chilean Declaration of Independence on 18 February 1818 Mexico and the majority of the countries in Central America and South America obtained independence from colonial overlords during the 19th century. In 1804, Haiti gained independence from France. In Mexico, the Mexican War of Independence was a decade-long conflict that ended in Mexican independence in 1821. Due to the Napoleonic Wars, the royal family of Portugal relocated to Brazil from 1808 to 1821, leading to Brazil having a separate monarchy from Portugal. The Federal Republic of Central America gained independence from Spain in 1821 and from Mexico in 1823. After several rebellions, by 1841 the federation had dissolved into the independent countries of Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica.[11] In 1830, the post-colonial nation of Gran Colombia dissolved and the nations of Colombia (including modern-day Panama), Ecuador, and Venezuela took its place. Main article: Revolutions of 1848 Liberal and nationalist pressure led to the European revolutions of 1848. The Revolutions of 1848 were a series of political upheavals throughout Europe in 1848. The revolutions were essentially democratic and liberal in nature, with the aim of removing the old monarchical structures and creating independent nation states. The first revolution began in January in Sicily.[clarification needed] Revolutions then spread across Europe after a separate revolution began in France in February. Over 50 countries were affected, but with no coordination or cooperation among their respective revolutionaries. According to Evans and von Strandmann (2000), some of the major contributing factors were widespread dissatisfaction with political leadership, demands for more participation in government and democracy, demands for freedom of the press, other demands made by the working class, the upsurge of nationalism, and the regrouping of established government forces.[12] Main articles: Abolitionism and American Civil War Politician and philanthropist William Wilberforce (1759–1833) was a leader of the movement to abolish the slave trade. The abolitionism movement achieved success in the 19th century. The Atlantic slave trade was abolished in the United States in 1808, and by the end of the century, almost every government had banned slavery. The Slavery Abolition Act 1833 banned slavery throughout the British Empire, and the Lei Áurea abolished slavery in Brazil in 1888. Abolitionism in the United States continued until the end of the American Civil War. Frederick Douglass and Harriet Tubman were two of many American abolitionists who helped win the fight against slavery. Douglass was an articulate orator and incisive antislavery writer, while Tubman worked with a network of antislavery activists and safe houses known as the Underground Railroad. The American Civil War took place from 1861 to 1865. Eleven southern states seceded from the United States, largely over concerns related to slavery. The Union Army was led by President Abraham Lincoln issued the Emancipation Proclamation. Lincoln issued a preliminary[13] on September 22, 1862, warning that in all states still in rebellion (Confederacy) on January 1, 1863, he would declare their slaves "then, thenceforward, and forever free."[14] He did so.[15] The Thirteenth Amendment to the United States Constitution,[16] ratified in 1865, officially abolished slavery in the entire country. Five days after Robert E. Lee surrendered at Appomattox Courthouse, Virginia, Lincoln was assassinated by actor and Confederate sympathizer John Wilkes Booth. Main article: Decline and modernization of the Ottoman Empire Ibrahim Pasha of Egypt, leader of the Egyptian army in the Egyptian–Ottoman War (1831–1833)[17] In 1817, the Principality of Serbia became suzerain from the Ottoman Empire, and in 1867, it passed a constitution that defined its independence from the Ottoman Empire. In 1830, Greece became the first country to break away from the Ottoman Empire after the Greek War of Independence. In 1831, the Bosnian Uprising against Ottoman rule occurred. In 1831, the First Egyptian–Ottoman War (1831–1833) occurred, between the Ottoman Empire and Egypt brought about by Muhammad Ali Pasha's demand to the Sublime Porte for control of Greater Syria, as a reward for aiding the Sultan during the Greek War of Independence. As a result, Egyptian forces temporarily gained control of Syria, advancing as far north as Kütahya.[18] In 1876, Bulgarians instigated the April Uprising against Ottoman rule. Following the Russo-Turkish War, the Treaty of Berlin recognized the formal independence of the Serbia, Montenegro and Romania. Bulgaria became autonomous. Main article: Taiping Rebellion A scene of the Taiping Rebellion The Taiping Rebellion was the bloodiest conflict of the 19th century, leading to the deaths of around 20–30 million people. Its leader, Hong Xiuquan, declared himself the younger brother of Jesus Christ and developed a new Chinese religion known as the God Worshipping Society. After proclaiming the establishment of the Taiping Heavenly Kingdom in 1851, the Taiping army conquered a large part of China, capturing Nanjing in 1853. In 1864, after the death of Hong Xiuquan, Qing forces recaptured Nanjing and ended the rebellion.[19] Main article: Meiji Restoration During the Edo period, Japan largely pursued an isolationist foreign policy. In 1853, United States Navy Commodore Matthew C. Perry threatened the Japanese capital Edo with gunships, demanding that they agree to open trade. This led to the opening of trade relations between Japan and foreign countries, with the policy of Sakoku formally ended in 1854. By 1872, the Japanese government under Emperor Meiji had eliminated the daimyō system and established a strong central government. Further reforms included the abolition of the samurai class, rapid industrialization and modernization of government, closely following European models.[20] Main articles: Western imperialism in Asia and Scramble for Africa Arrival of Marshal Randon in Algiers, French Algeria in 1857 The Maratha Confederacy and the East India Company sign the Treaty of Bassein in 1802. 1803: United States more than doubles in size when it buys out France's territorial claims in North America via the Louisiana Purchase. This begins the U.S.'s westward expansion to the Pacific, referred to as its Manifest Destiny, which involves annexing and conquering land from Mexico, Britain, and Native Americans. 1817 – 1819: British Empire annexed the Maratha Confederacy after the Third Anglo-Maratha War. 1823 – 1887: British Empire annexed Burma (now also called Myanmar) after three Anglo-Burmese Wars. 1848 – 1849: Sikh Empire is defeated in the Second Anglo-Sikh War. Therefore, the entire Indian subcontinent is under British control. 1862: France gained its first foothold in Southeast Asia and in 1863 annexed Cambodia. 1867: United States purchased Alaska from Russia. Comparison of Africa in the years 1880 and 1913 In Africa, European exploration and technology led to the colonization of almost the entire continent by 1898. New medicines such as quinine and more advanced firearms allowed European nations to conquer native populations.[21] Motivations for the Scramble for Africa included national pride, desire for raw materials, and Christian missionary activity. Britain seized control of Egypt to ensure control of the Suez Canal, but Ethiopia defeated Italy in the First Italo–Ethiopian War at the Battle of Adwa. France, Belgium, Portugal, and Germany also had substantial colonies. The Berlin Conference of 1884–1885 attempted to reach agreement on colonial borders in Africa, but disputes continued, both amongst European powers and in resistance by the native populations.[21] Much of southern Africa was developed by British and business interests, led by Cecil Rhodes.[21] 1801–1815: First Barbary War and the Second Barbary War between the United States and the Barbary States of North Africa. 1802: Tay Son army recaptured Phu Xuan, causing Vo Tanh to commit suicide, Nguyen Phuc Anh successfully captured Thang Long, founded the Nguyen dynasty 1804–1810: Fulani Jihad in Nigeria. 1804–1813: Russo-Persian War. 1806–1812: Russo-Turkish War, Treaty of Bucharest. 1807–1837: Musket Wars among Māori in many parts of New Zealand. 1808–1809: Russia conquers Finland from Sweden in the Finnish War. 1816: Shaka rises to power over the Zulu Kingdom. Zulu expansion was a major factor of the Mfecane ("Crushing") that depopulated large areas of southern Africa. 1810: Grito de Dolores begins the Mexican War of Independence. 1811: Battle of Tippecanoe: U.S. outnumbering Native Americans resulting in defeat and burning of community 1812–1815: War of 1812 between the United States and Britain; ends in a draw, except that Native Americans lose power. 1813–1837: Afghan–Sikh Wars. 1814–1816: Anglo-Nepalese War between Nepal (Gurkha Empire) and British Empire. 1817: Russia begins its conquest of the Caucasus. 1820: Revolutions of 1820 in Southern Europe 1821–1830: Greek War of Independence against the Ottoman Empire. 1825–1830: Java War begins. 1826–1828: After the final Russo-Persian War, the Persian Empire took back territory lost to Russia from the previous war. 1828–1832: Black War in Tasmania leads to the near extinction of the Tasmanian aborigines 1830: July Revolution overthrew old line of Bourbons. 1830: November Uprising in Poland against Russia. 1830: Belgian Revolution results in Belgium's independence from Netherlands. 1830: End of the Java War. The whole area of Yogyakarta and Surakarta Manca nagara Dutch seized. 27 September, Klaten Agreement determines a fixed boundary between Surakarta and Yogyakarta and permanently divide the kingdom of Mataram was signed by Sasradiningrat, Pepatih Dalem Surakarta, and Danurejo, Pepatih Dalem Yogyakarta. Mataram is a de facto and de jure controlled by the Dutch East Indies. 1831: France invades and occupies Algeria. 1831–1833: Egyptian–Ottoman War. 1832–1875: Regimental rebellions of Brazil 1835–1836: Texas Revolution results in Texas's independence from Mexico. 1839–1842: First Opium War begins, resulting in the secession of much of the modern-day Southern Chinese coast to Britain. 1848: February Revolution overthrew Louis Philippe's government, Louis Napoleon, nephew of Napoleon I, elected president. 1853–1856: Crimean War between the Ottoman Empire, the United Kingdom, the Ottoman Empire, and Russia. 1856–1860: Second Opium War 1857: Indian Rebellion against the Company Raj. After this the power of the East India Company is transferred to the British Crown. 1859: Franco-Austrian War is part of the wars of Italian unification. 1861–1865: American Civil War between the Union and seceding Confederacy. Dead Confederate soldiers. In the American Civil War, 30% of all Southern white males aged 18–40 were killed.[22] 1861–1867: French intervention in Mexico and the creation of the Second Mexican Empire, ruled by Maximilian I of Mexico and his consort Carlota of Mexico. 1863–1865: January Uprising against Russia. 1864–1870: Paraguayan War ends Paraguayan ambitions for expansion and destroys much of the Paraguayan population. 1866: Austro-Prussian War results in the dissolution of the German Confederation and the creation of the North German Confederation and the Austrian-Hungarian Dual Monarchy. 1868–1869: Boshin War results in end of the shogunate and the founding the Japanese Empire. 1868–1878: Ten Years' War between Cuba and Spain. 1870–1871: Franco-Prussian War results in the unification of Germany and Italy, the collapse of the Second French Empire and the emergence of a New Imperialism. 1870: Napoleon III captured at Sedan and resigned through conclusion of Franco-Prussian War. Third Republic proclaimed. 1876: The April Uprising in Bulgaria against the Ottoman Empire. 1879: Anglo-Zulu War results in British victory and the annexation of the Zulu Kingdom. 1879–1880: Little War against Spanish rule in Cuba leads to rebel defeat. 1879–1884: War of the Pacific between Chile and Peru and Bolivia over Andean territory in the War of the Pacific. 1880–1881: First Boer War begins. 1881–1899: Mahdist War in Sudan. A depiction of the Battle of Omdurman, 1898. During the battle, Winston Churchill took part in a cavalry charge. 1882: Anglo-Egyptian War British invasion and subsequent occupation of Egypt 1883–1898: Mandingo Wars between the French colonial empire and the Wassoulou Empire of the Mandingo people led by Samory Touré. 1894–1895: After the First Sino-Japanese War, China cedes Taiwan to Japan and grants Japan a free hand in Korea. 1895: Taiwan is ceded to Japan as a result of the First Sino-Japanese War. 1895–1896: Ethiopia defeats Italy in the First Italo-Ethiopian War at the Battle of Adwa. 1895–1898: Cuban War for Independence results in Cuba becoming independent of Spain. 1898: Spanish–American War results in a Philippine victory. 1899–1901: Boxer Rebellion in China. 1899–1902: Thousand Days' War in Colombia breaks out between the "Liberales" and "Conservadores", culminating with the loss of Panama in 1903. 1899–1902: Second Boer War begins. 1899–1902: Philippine–American War begins. Distinguished Men of Science.[23] Use the cursor to see who is who.[24] Main article: 19th century in science The 19th century saw the birth of science as a profession; the term scientist was coined in 1833 by William Whewell,[25] which soon replaced the older term of natural philosopher. Among the most influential ideas of the 19th century were those of Charles Darwin (alongside the independent researches of Alfred Russel Wallace), who in 1859 published the book The Origin of Species, which introduced the idea of evolution by natural selection. Another important landmark in medicine and biology were the successful efforts to prove the germ theory of disease. Following this, Louis Pasteur made the first vaccine against rabies, and also made many discoveries in the field of chemistry, including the asymmetry of crystals. In chemistry, Dmitri Mendeleev, following the atomic theory of John Dalton, created the first periodic table of elements. In physics, the experiments, theories and discoveries of Michael Faraday, André-Marie Ampère, James Clerk Maxwell, and their contemporaries led to the creation of electromagnetism as a new branch of science. Thermodynamics led to an understanding of heat and the notion of energy was defined. Other highlights include the discoveries unveiling the nature of atomic structure and matter, simultaneously with chemistry – and of new kinds of radiation. In astronomy, the planet Neptune was discovered. In mathematics, the notion of complex numbers finally matured and led to a subsequent analytical theory; they also began the use of hypercomplex numbers. Karl Weierstrass and others carried out the arithmetization of analysis for functions of real and complex variables. It also saw rise to new progress in geometry beyond those classical theories of Euclid, after a period of nearly two thousand years. The mathematical science of logic likewise had revolutionary breakthroughs after a similarly long period of stagnation. But the most important step in science at this time were the ideas formulated by the creators of electrical science. Their work changed the face of physics and made possible for new technology to come about including a rapid spread in the use of electric illumination and power in the last two decades of the century and radio wave communication at the end of the 1890s. Michael Faraday (1791–1867) Charles Darwin (1809–1882) 1807: Potassium and Sodium are individually isolated by Sir Humphry Davy. 1831–1836: Charles Darwin's journey on HMS Beagle. 1859: Charles Darwin publishes On the Origin of Species. 1861: James Clerk Maxwell publishes On Physical Lines of Force, formulating the four Maxwell's equations. 1865: Gregor Mendel formulates his laws of inheritance. 1869: Dmitri Mendeleev creates the Periodic table. 1873: Maxwell's A Treatise on Electricity and Magnetism published. 1877: Asaph Hall discovers the moons of Mars 1896: Henri Becquerel discovers radioactivity; J. J. Thomson identifies the electron, though not by name. Robert Koch identifies the tuberculosis bacilli. In the 19th century, the disease killed an estimated 25% of the adult population of Europe.[26] 1804: Morphine first isolated. 1842: Anesthesia used for the first time. 1847: Chloroform invented for the first time, given to Queen Victoria at the birth of her eighth child, Prince Leopold in 1853 1855: Cocaine is isolated by Friedrich Gaedcke. 1885: Louis Pasteur creates the first successful vaccine against rabies for a young boy who had been bitten 14 times by a rabid dog. 1889: Aspirin patented. Thomas Edison was an American inventor, scientist, and businessman who developed many devices that greatly influenced life around the world, including the motion picture camera, phonograph and long-lasting, practical electric light bulb. Built for the Netphener bus company in 1895, the Benz Omnibus was the first motor bus in history. 1804: First steam locomotive begins operation. 1816: Laufmaschine invented by Karl von Drais. 1825: Erie Canal opened connecting the Great Lakes to the Atlantic Ocean. 1825: First isolation of aluminium. 1827: First photograph taken (technique of heliography) by Joseph Nicéphore Niépce. 1825: The Stockton and Darlington Railway, the first public railway in the world, is opened. 1826: Samuel Morey patents the internal combustion engine. 1829: First electric motor built. 1837: Telegraph patented. 1841: The word "dinosaur" is coined by Richard Owen. 1844: First publicly funded telegraph line in the world—between Baltimore and Washington—sends demonstration message on 24 May, ushering in the age of the telegraph. This message read "What hath God wrought?" (Bible, Numbers 23:23) 1849: The safety pin and the gas mask are invented. 1852: The first successful blimp is invented. 1855: Bessemer process enables steel to be mass-produced. 1856: World's first oil refinery in Romania 1858: Invention of the phonautograph, the first true device for recording sound. 1859: The first ironclad was launched into sea by the French Navy. 1860: Benjamin Tyler Henry invents the 16-shot Henry Rifle 1861: Richard Gatling invents the Gatling Gun, first modern machine gun used notably in the battles of Cold Harbor and Petersburg 1862: First meeting in combat of ironclad warships, USS Monitor and CSS Virginia, during the American Civil War. 1863: First section of the London Underground opens. 1866: Successful transatlantic telegraph cable follows an earlier attempt in 1858. 1867: Alfred Nobel invents dynamite. 1868: Safety bicycle invented. 1869: First transcontinental railroad completed in United States on 10 May. 1870: Rasmus Malling-Hansen's invention the Hansen Writing Ball becomes the first commercially sold typewriter. 1873: Blue jeans and barbed wire are invented. 1877: Thomas Edison invents the phonograph 1878: First commercial telephone exchange in New Haven, Connecticut. c. 1875/1880: Introduction of the widespread use of electric lighting. These included early crude systems in France and the UK and the introduction of large scale outdoor arc lighting systems by 1880.[27] 1879: Thomas Edison patents a practical incandescent light bulb. 1882: Introduction of large scale electric power utilities with the Edison Holborn Viaduct (London) and Pearl Street (New York) power stations supplying indoor electric lighting using Edison's incandescent bulb.[28][29] 1884: Sir Hiram Maxim invents the first self-powered Machine gun, the Maxim gun. 1885: Singer begins production of the 'Vibrating Shuttle', which would become the most popular model of sewing machine. 1886: Karl Benz sells the first commercial automobile. 1890: The cardboard box is invented. 1892: John Froelich develops and constructs the first gasoline/petrol-powered tractor. 1894: Karl Elsener invents the Swiss Army knife. 1894: First gramophone record. 1895: Wilhelm Röntgen identifies x-rays. Brigham Young led the LDS Church from 1844 until his death in 1877. 1818: The first permanent Reform Judaism congregation, the Neuer Israelitischer Tempel, is founded in Hamburg on October 18. Around the same time, the development of Wissenschaft des Judentums, the scholarly study of Jewish history, begins. 1830: The Church of Jesus Christ of Latter Day Saints is established. 1844: The Bab announces his revelation on 23 May, founding Bábism. He announced to the world of the coming of "He whom God shall make manifest". He is considered the forerunner of Bahá'u'lláh, the founder of the Bahá'í Faith. 1850s–1890s: In Islam, Salafism grows in popularity. 1851: Hong Xiuquan, the leader of the God Worshipping Society, founds the Taiping Heavenly Kingdom. 1857: In Paris, France, Allan Kardec, publishes The Spirits' Book and founds the Spiritism. 1868: In Japan, State Shinto is established amidst the Meiji Restoration. 1869–1870: The First Vatican Council is convened, articulating the dogma of papal infallibility and promoting a revival of scholastic theology. 1871–1878: In Germany, Otto von Bismarck challenges the Catholic Church in the Kulturkampf ("Culture War") 1875: Helena Blavatsky co-founds the Theosophical Society and becomes the leading articulator of Theosophy. 1879: Mary Baker Eddy founds the Church of Christ, Scientist. The Watchtower, published by the Jehovah's Witnesses, releases its first issue. 1881: In the Sudan, Muhammad Ahmad claims to be the Mahdi, founding the Mahdist State and declaring war on the Khedivate of Egypt. 1889: Mirza Ghulam Ahmad establishes the Ahmadiyya Muslim Community. 1891: Pope Leo XIII issues the papal encyclical Rerum novarum, the first major document informing modern Catholic social teaching. The Great Exhibition in London. Starting during the 18th century, the UK was the first country in the world to industrialize. 1808: Beethoven composes his Fifth Symphony 1813: Jane Austen publishes Pride and Prejudice 1818: Mary Shelley publishes Frankenstein; or, The Modern Prometheus. 1819: John Keats writes his six of his best-known odes. 1819: Théodore Géricault paints his masterpiece The Raft of the Medusa, and exhibits it in the French Salon of 1819 at the Louvre. 1824: Premiere of Beethoven's Ninth Symphony. 1829: Johann Wolfgang von Goethe's Faust premieres. 1833–1834: Thomas Carlyle publishes Sartor Resartus. 1837: Charles Dickens publishes Oliver Twist. 1841: Ralph Waldo Emerson publishes Self-Reliance. 1845: Frederick Douglass publishes Narrative of the Life of Frederick Douglass, an American Slave. 1847: The Brontë sisters publish Jane Eyre, Wuthering Heights and Agnes Grey. 1848: Karl Marx and Friedrich Engels publish The Communist Manifesto. 1849: Josiah Henson publishes The Life of Josiah Henson, Formerly a Slave, Now an Inhabitant of Canada, as Narrated by Himself. 1851: Herman Melville publishes Moby-Dick. 1851: Sojourner Truth delivers the speech "Ain't I a Woman?". 1852: Harriet Beecher Stowe publishes Uncle Tom's Cabin. 1855: Walt Whitman publishes the first edition of Leaves of Grass. 1855: Frederick Douglass publishes the first edition of My Bondage and My Freedom. 1862: Victor Hugo publishes Les Misérables. 1863: Jules Verne begins publishing his collection of stories and novels, Voyages extraordinaires, with the novel Cinq semaines en ballon. 1865: Lewis Carroll publishes Alice's Adventures in Wonderland. 1869: Leo Tolstoy publishes War and Peace. Auguste Renoir, Bal du moulin de la Galette, 1876, Musée d'Orsay 1875: Georges Bizet's opera Carmen premiers in Paris. 1876: Richard Wagner's Ring Cycle is first performed in its entirety. 1883: Robert Louis Stevenson's Treasure Island is published. 1884: Mark Twain publishes the Adventures of Huckleberry Finn. 1886: Strange Case of Dr Jekyll and Mr Hyde by Robert Louis Stevenson is published. 1887: Sir Arthur Conan Doyle publishes his first Sherlock Holmes story, A Study in Scarlet. 1889: Vincent van Gogh paints The Starry Night. 1889: Moulin Rouge opens in Paris. 1892: Tchaikovsky's Nutcracker Suite premieres in St Petersburg. 1894: Rudyard Kipling's The Jungle Book is published 1895: Trial of Oscar Wilde and premiere of his play The Importance of Being Earnest. 1897: Bram Stoker writes Dracula. 1900: L. Frank Baum publishes The Wonderful Wizard of Oz. Main articles: Romantic poetry and 19th century in literature Russian writer Leo Tolstoy, author of War and Peace and Anna Karenina On the literary front the new century opens with romanticism, a movement that spread throughout Europe in reaction to 18th-century rationalism, and it develops more or less along the lines of the Industrial Revolution, with a design to react against the dramatic changes wrought on nature by the steam engine and the railway. William Wordsworth and Samuel Taylor Coleridge are considered the initiators of the new school in England, while in the continent the German Sturm und Drang spreads its influence as far as Italy and Spain. French arts had been hampered by the Napoleonic Wars but subsequently developed rapidly. Modernism began.[30] The Goncourts and Émile Zola in France and Giovanni Verga in Italy produce some of the finest naturalist novels. Italian naturalist novels are especially important in that they give a social map of the new unified Italy to a people that until then had been scarcely aware of its ethnic and cultural diversity. There was a huge literary output during the 19th century. Some of the most famous writers included the Russians Alexander Pushkin, Nikolai Gogol, Leo Tolstoy, Anton Chekhov and Fyodor Dostoyevsky; the English Charles Dickens, John Keats, Alfred, Lord Tennyson and Jane Austen; the Scottish Sir Walter Scott, Thomas Carlyle and Arthur Conan Doyle (creator of the character Sherlock Holmes); the Irish Oscar Wilde; the Americans Edgar Allan Poe, Ralph Waldo Emerson, and Mark Twain; and the French Victor Hugo, Honoré de Balzac, Jules Verne, Alexandre Dumas and Charles Baudelaire.[31] Some American literary writers, poets and novelists were: Walt Whitman, Mark Twain, Harriet Ann Jacobs, Nathaniel Hawthorne, Ralph Waldo Emerson, Herman Melville, Frederick Douglass, Harriet Beecher Stowe, Joel Chandler Harris, and Emily Dickinson to name a few. See also: History of photography, List of photojournalists, Photojournalism, and Daguerreotype One of the first photographs, produced by Nicéphore Niépce in 1826 Nadar self-portrait, c. 1860 Ottomar Anschütz, chronophotographer Mathew Brady, documented the American Civil War Edward S. Curtis, documented the American West notably Native Americans Louis Daguerre, inventor of daguerreotype process of photography, chemist Thomas Eakins, pioneer motion photographer George Eastman, inventor of roll film Hercules Florence, pioneer inventor of photography Auguste and Louis Lumière, pioneer film-makers, inventors Étienne-Jules Marey, pioneer motion photographer Eadweard Muybridge, pioneer motion photographer, chronophotographer Nadar a.k.a. Gaspard-Félix Tournachon, portrait photographer Nicéphore Niépce, pioneer inventor of photography Louis Le Prince, motion picture inventor and pioneer film-maker Sergey Prokudin-Gorsky, chemist and photographer William Fox Talbot, inventor of the negative / positive photographic process. Main articles: History of art § 19th century, Western painting, and Ukiyo-e Francisco Goya, The Third of May 1808, 1814, Museo del Prado Eugène Delacroix, Liberty Leading the People, 1830, Louvre Vincent van Gogh, Self-portrait, 1889, National Gallery of Art Biscuits Lefèvre-Utile poster artwork by Alphonse Mucha, 1897 The Realism and Romanticism of the early 19th century gave way to Impressionism and Post-Impressionism in the latter half of the century, with Paris being the dominant art capital of the world. In the United States the Hudson River School was prominent. 19th-century painters included: Ivan Aivazovsky Léon Bakst Albert Bierstadt William Blake Arnold Böcklin Rosa Bonheur William Burges Mary Cassatt Camille Claudel Paul Cézanne Frederic Edwin Church Thomas Cole Jan Matejko John Constable Camille Corot Gustave Courbet Honoré Daumier Edgar Degas Eugène Delacroix Thomas Eakins Caspar David Friedrich Paul Gauguin Théodore Géricault Vincent van Gogh William Morris Francisco Goya Andō Hiroshige Hokusai Winslow Homer Jean-Auguste-Dominique Ingres Isaac Levitan Édouard Manet Claude Monet Gustave Moreau Berthe Morisot Edvard Munch Mikhail Nesterov Camille Pissarro Augustus Pugin Pierre-Auguste Renoir Ilya Repin Auguste Rodin Albert Pinkham Ryder John Singer Sargent Valentin Serov Georges Seurat Ivan Shishkin Vasily Surikov James Tissot Henri de Toulouse-Lautrec Joseph Mallord William Turner Viktor Vasnetsov Eugène Viollet-le-Duc Mikhail Vrubel James Abbott McNeill Whistler Tsukioka Yoshitoshi Main articles: List of Romantic-era composers, Romantic music, and Romanticism Ludwig van Beethoven (1770–1827) Pyotr Ilyich Tchaikovsky (1840–1893) Sonata form matured during the Classical era to become the primary form of instrumental compositions throughout the 19th century. Much of the music from the 19th century was referred to as being in the Romantic style. Many great composers lived through this era such as Ludwig van Beethoven, Franz Liszt, Frédéric Chopin, Pyotr Ilyich Tchaikovsky, and Richard Wagner. The list includes: Mily Balakirev Ludwig van Beethoven Hector Berlioz Georges Bizet Alexander Borodin Johannes Brahms Anton Bruckner Frédéric Chopin Claude Debussy Antonín Dvořák Mikhail Glinka Edvard Grieg Scott Joplin Alexandre Luigini Franz Liszt Gustav Mahler Felix Mendelssohn Modest Mussorgsky Jacques Offenbach Niccolò Paganini Nikolai Rimsky-Korsakov Gioachino Rossini Anton Rubinstein Camille Saint-Saëns Antonio Salieri Franz Schubert Robert Schumann Alexander Scriabin Arthur Sullivan Pyotr Ilyich Tchaikovsky Giuseppe Verdi Richard Wagner 1858: The Melbourne Football Club was formed, starting the sport of Australian Rules Football 1867: The Marquess of Queensberry Rules for boxing are published. 1872: The first recognised international football match, between England and Scotland, is played. 1877: The first test cricket match, between England and Australia, is played. 1891: Basketball is invented by James Naismith. 1895: Volleyball is invented. 1896: Olympic Games revived in Athens. For a chronological guide, see Timeline of the 19th century. Main articles: 1800s, 1810s, 1820s, 1830s, and 1840s 1801: The Kingdom of Great Britain and the Kingdom of Ireland merge to form the United Kingdom. 1801: Thomas Jefferson is elected the third President of the United States; he serves until 1809. 1802: The Wahhabis of the First Saudi State sack Karbala. 1803: William Symington demonstrates his Charlotte Dundas, the "first practical steamboat". 1803: The Wahhabis of the First Saudi State capture Mecca and Medina. 1804: Austrian Empire founded by Francis I. 1804: World population reaches 1 billion. 1805: The Battle of Trafalgar eliminates the French and Spanish naval fleets and allows for British dominance of the seas, a major factor for the success of the British Empire later in the century. 1805–1848: Muhammad Ali modernizes Egypt. 1819: 29 January, Stamford Raffles arrives in Singapore with William Farquhar to establish a trading post for the British East India Company; 8 February, the treaty is signed between Sultan Hussein of Johor, Temenggong Abdul Rahman and Stamford Raffles. Farquhar is installed as the first Resident of the settlement. 1810: The University of Berlin was founded. Among its students and faculty are Hegel, Marx, and Bismarck. The German university reform proves to be so successful that its model is copied around the world (see History of European research universities). 1814: Elisha Collier invents the Flintlock Revolver. 1814: February 1 Eruption of Mayon Volcano 1815: April, Mount Tambora in Sumbawa island erupts, becoming the largest volcanic eruption in recorded history, destroying Tambora culture, and killing at least 71,000 people, including its aftermath. The eruption created global climate anomalies known as "volcanic winter".[32] 1816: Year Without a Summer: Unusually cold conditions wreak havoc throughout the Northern Hemisphere, likely influenced by the 1815 explosion of Mount Tambora. 1816–1828: Shaka's Zulu Kingdom becomes the largest in Southern Africa. 1819: The Republic of Colombia (Gran Colombia) achieves independence after Simón Bolívar's triumph at the Battle of Boyacá. 1819: The modern city of Singapore is established by the British East India Company. 1820: Discovery of Antarctica. 1820: Liberia founded by the American Colonization Society for freed American slaves. 1820: Dissolution of the Maratha Empire. 1821–1823: First Mexican Empire, as Mexico's first post-independent government, ruled by Emperor Agustín I of Mexico. 1822: Pedro I of Brazil declared Brazil's independence from Portugal on 7 September. 1823: Monroe Doctrine declared by US President James Monroe. 1825: The Decembrist revolt. Decembrists at the Senate Square 1829: Sir Robert Peel founds the Metropolitan Police force. Emigrants leaving Ireland. From 1830 to 1914, almost 5 million Irish people emigrated to the United States. 1830: Anglo-Russian rivalry over Afghanistan, the Great Game, commences and concludes in 1895. 1831: November Uprising ends with crushing defeat for Poland in the Battle of Warsaw. 1832: The British Parliament passes the Great Reform Act 1832. 1834–1859: Imam Shamil's rebellion in the Russian-occupied Caucasus. 1835–1836: The Texas Revolution in Mexico resulted in the short-lived Republic of Texas. 1836: Samuel Colt popularizes the revolver and sets up a firearms company to manufacture his invention of the Colt Paterson revolver, a six bullets firearm shot one by one without reloading manually. 1837–1838: Rebellions of 1837 in Canada. 1838: By this time, 46,000 Native Americans have been forcibly relocated in the Trail of Tears. 1839–1860: After the First and Second Opium Wars, France, the United Kingdom, the United States and Russia gain many trade and associated concessions from China resulting in the start of the decline of the Qing dynasty. 1839–1919: Anglo-Afghan Wars lead to stalemate and the establishment of the Durand line 1842: Treaty of Nanking cedes Hong Kong to the British. 1843: The first wagon train sets out from Missouri. 1844: Rochdale Society of Equitable Pioneers establish what is considered the first cooperative in the world. 1845–1849: The Great Famine of Ireland leads to the Irish diaspora. 1848: The Communist Manifesto published. 1848: Seneca Falls Convention is the first women's rights convention in the United States and leads to the battle for women's suffrage. 1848–1855: California Gold Rush. 1849: Earliest recorded air raid, as Austria employs 200 balloons to deliver ordnance against Venice. 1850: The Little Ice Age ends around this time. 1850: Franz Hermann Schulze-Delitzsch establishes the first cooperative financial institution. Historical territorial expansion of the United States Main articles: 1850s, 1860s, 1870s, 1880s, 1890s, and 1900s For later events, see Timeline of the 20th century. 1851: The Great Exhibition in London was the world's first international Expo or World Fair. 1852: Frederick Douglass delivers his speech "The Meaning of July Fourth for the Negro" in Rochester, New York. 1857: Sir Joseph Whitworth designs the first long-range sniper rifle. 1857–1858: Indian Rebellion of 1857. The British Empire assumes control of India from the East India Company. 1858: Construction of Big Ben is completed. 1859–1869: Suez Canal is constructed. The first vessels sail through the Suez Canal. 1860: Giuseppe Garibaldi launches the Expedition of the Thousand. 1861: Russia abolishes serfdom. 1862–1877: Muslim Rebellion in north-west China. 1863: Formation of the International Red Cross is followed by the adoption of the First Geneva Convention in 1864. 1865–1877: Reconstruction in the United States; Slavery is banned in the United States by the Thirteenth Amendment to the United States Constitution. 1867: Canada is formed, via the process of Canadian Confederation. 1868: Michael Barrett is the last person to be publicly hanged in England. 1869: The Suez Canal opens linking the Mediterranean to the Red Sea. A barricade in the Paris Commune, 18 March 1871. Around 30,000 Parisians were killed, and thousands more were later executed. Black Friday, 9 May 1873, Vienna Stock Exchange. The Panic of 1873 and Long Depression followed. 1870: Official dismantling of the Cultivation System and beginning of a 'Liberal Policy' of deregulated exploitation of the Netherlands East Indies.[33] 1870–1890: Long Depression in Western Europe and North America. 1871–1872: Famine in Persia is believed to have caused the death of 2 million. 1871: The Paris Commune briefly rules the French capital. 1872: Yellowstone National Park, the first national park, is created. 1874: The Société Anonyme Coopérative des Artistes Peintres, Sculpteurs, and Graveurs, better known as the Impressionists, organize and present their first public group exhibition at the Paris studio of the photographer Nadar. 1874: The Home Rule Movement is established in Ireland. 1875: HMS Challenger surveys the deepest point in the Earth's oceans, the Challenger Deep 1876: Battle of the Little Bighorn leads to the death of General Custer and victory for the alliance of Lakota, Cheyenne and Arapaho 1876–1914: The massive expansion in population, territory, industry and wealth in the United States is referred to as the Gilded Age. 1877: Great Railroad Strike in the United States may have been the world's first nationwide labour strike. 1881: Wave of pogroms begins in the Russian Empire. 1881–1882: The Jules Ferry laws are passed in France establishing free, secular education. 1883: Krakatoa volcano explosion, one of the largest in modern history. 1883: The quagga is rendered extinct. 1886: Construction of the Statue of Liberty; Coca-Cola is developed. 1888: Founding of the shipping line Koninklijke Paketvaart-Maatschappij (KPM) that supported the unification and development of the colonial economy.[33] 1888: The Golden Law abolishes slavery in Brazil. 1889: Eiffel Tower is inaugurated in Paris. Studio portrait of Ilustrados in Europe, c. 1890 1889: A republican military coup establishes the First Brazilian Republic. The parliamentary constitutional monarchy is abolished. 1889–1890: 1889–1890 pandemic kills 1 million people. 1890: First use of the electric chair as a method of execution. 1892: The World's Columbian Exposition was held in Chicago celebrating the 400th anniversary of Christopher Columbus's arrival in the New World. 1892: Fingerprinting is officially adopted for the first time. 1893: New Zealand becomes the first country to enact women's suffrage. 1893: The Coremans-de Vriendt law is passed in Belgium, creating legal equality for French and Dutch languages. 1894: The Dutch intervention in Lombok and Karangasem[33] resulted in the looting and destruction of Cakranegara Palace in Mataram.[34] J. L. A. Brandes, a Dutch philologist, discovers and secures Nagarakretagama manuscript in Lombok royal library. 1896: Philippine Revolution ends declaring Philippines free from Spanish rule. 1898: The United States gains control of Cuba, Puerto Rico, and the Philippines after the Spanish–American War. 1898: Empress Dowager Cixi of China engineers a coup d'état, marking the end of the Hundred Days' Reform; the Guangxu Emperor is arrested. 1900: Exposition Universelle held in Paris, prominently featuring the growing art trend Art Nouveau. 1900–1901: Eight nations invade China at the same time and ransack Forbidden City. Born on 19 April 1897, Japanese Jiroemon Kimura died on 12 June 2013, marking the death of the last man verified to have been born in the century.[35][36][37] Kimura remains to date the oldest verified man in history.[38] Subsequently, on 21 April 2018, Japanese Nabi Tajima (born 4 August 1900) died as the last person to verifiably have been born in the century.[39] Carl Friedrich Gauss Charles Darwin Victor Hugo, c. 1876 Dmitri Mendeleev Louis Pasteur, 1878 Marie Curie, c. 1898 Nikola Tesla José Rizal Jane Austen Leo Tolstoy, c. 1897 Edgar Allan Poe Jules Verne Charles Dickens Arthur Rimbaud, c. 1872 Mark Twain, 1894 Ralph Waldo Emerson Henry David Thoreau, 1861 Émile Zola, c. 1900 Anton Chekhov Fyodor Dostoevsky, 1876 John L Sullivan in his prime, c. 1882 David Livingstone 1864, left Britain for Africa in 1840 Jesse and Frank James, 1872 Sitting Bull and Buffalo Bill, in a studio portrait from 1885 Geronimo, 1887, prominent leader of the Chiricahua Apache William Bonney aka Henry McCarty aka Billy the Kid, c. late 1870s Deputies Bat Masterson and Wyatt Earp in Dodge City, 1876 Mathew Brady, self-portrait, c. 1875 Alfred, Lord Tennyson Thomas Nast, c. 1860–1875, photo by Mathew Brady or Levin Handy Mirza Ghulam Ahmad Mikhail Bakunin Søren Kierkegaard Solomon Northup Dred Scott Madam C. J. Walker Claude Monet's Impression, Sunrise (1872) gave the name to Impressionism. Paul Cézanne, self-portrait, 1880–1881 Scott Joplin Niccolò Paganini, c. 1819 Frédéric Chopin, 1838 John D. Rockefeller Timelines of modern history Long nineteenth century 19th century in film 19th century in games 19th-century philosophy Nineteenth-century theatre International relations (1814–1919) List of wars: 1800–1899 Victorian era France in the long nineteenth century History of Spain (1808–1874) History of Russia (1855–1892) Slavery in the United States Timeline of 19th-century Muslim history Timeline of historic inventions ^ Cleveland, William L.; Bunton, Martin (2016). A History of the Modern Middle East. doi:10.4324/9780429495502. ISBN 9780429495502. S2CID 153025861. The 19th century is frequently characterized as a period of tension between forces of continuity and change. The reformers who advocated the adoption of European institutions and technology, have often been portrayed as the progressive elements of society courageously charting the course toward an inevitably Westernized twentieth century. Conversely, the adherents of continuity, who viewed with alarm the dismantling of the Islamic order and sought to preserve tradition and retain the values and ideals that had served Ottoman and Islamic society so well for so long, are sometimes portrayed as nothing but archaic reactionaries. But we should avoid these simplistic characterizations if we are to appreciate the agonizing and dangerous process of transforming an established religious, social and political worldview. ^ "The First Telephone Call". www.americaslibrary.gov. Archived from the original on 2015-10-22. Retrieved 2015-10-25. ^ "Dec. 18, 1878: Let There Be Light — Electric Light". WIRED. 18 December 2009. Archived from the original on 21 October 2016. 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View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Andy Warhol (links | edit) Century (links | edit) List of decades, centuries, and millennia (links | edit) December 6 (links | edit) Folk music (links | edit) Flag of the United States (links | edit) Geologic time scale (links | edit) Lavandula (links | edit) History of Mali (links | edit) Stock exchange (links | edit) Thuggee (links | edit) Republican Party (United States) (links | edit) 1960s (links | edit) 2000 (links | edit) 1977 (links | edit) 1964 (links | edit) 1999 (links | edit) 1970s (links | edit) 1990s (links | edit) 1980s (links | edit) 20th century (links | edit) 15th century (links | edit) 16th century (links | edit) 17th century (links | edit) 18th century (links | edit) 1950s (links | edit) 1870s (links | edit) 1952 (links | edit) 1984 (links | edit) 1940s (links | edit) 1947 (links | edit) 1756 (links | edit) 1791 (links | edit) 1818 (links | edit) 1918 (links | edit) 1917 (links | edit) 1743 (links | edit) 1826 (links | edit) 1993 (links | edit) 1908 (links | edit) 1997 (links | edit) 1951 (links | edit) 1949 (links | edit) 1911 (links | edit) 1957 (links | edit) 1931 (links | edit) 1926 (links | edit) 1969 (links | edit) 1948 (links | edit) 1930s (links | edit) View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500) Retrieved from " WhatLinksHere/19th_century" Page 2 A satellite communication channel provides broad-area coverage in a continental as well as intercontinental sense. Moreover, access to remote areas not covered by conventional cable or fiber communications is also a distinct feature of satellites. The basic elements of satellite communication system are earth stations, terrestrial system and users. The basic structure of a satellite communication system is shown in Fig. 24.7. Satellite communication system consist of many earth stations on the ground and these are linked with a satellite in space. The user is connected to the earth station through a terrestrial network and this terrestrial network may be a telephone switch or dedicated link to a earth station. The user generates a baseband signal that is processed through a terrestrial network and transmitted to a satellite at the earth station. The satellite consists of a large number of repeaters in space, receives the modulated RF carrier in its uplink frequency spectrum from all the earth stations in the network, amplifies these carriers and retransmits them back to the earth stations in the downlink frequency spectrum. To avoid the interference downlink frequency spectrum should be different from uplink frequency spectrum. The signal at the receiving earth stations is processed to get back the baseband signal, it is sent to the user through a terrestrial network. Commercial satellite communication system use a frequency band of 500 MHz bandwidth near 6 GHz for uplink transmission and another 500 MHz bandwidth near 4 GHz for downlink transmission. An uplink of 5.725 to 7.075 GHz and a downlink of 3.4 to 4.8 GHz is used. Since 6/4 GHz band is also used in many countries for microwave links (terrestrial communications), so the problem of mutual interference may occurs. The 500 MHz allocation of frequency band is usually divided into 12 channels of approximately 40 MHz each. This allows each of 12 transponders to carry one TV channel or 1500 analog FM voice circuits. Modern satellite communication system also employ frequency reuse to increase the number of transponders in the allotted bandwidth. 6/4 GHz band is most popular because of less propagation problem. Rain attenuation and sky noise is low at 4 GHz so it is possible to build a receiving system. 14/12 GHz band is also used in commercial communication satellites because of over crowding of geostationary satellites at 6/4 GHz band. Here uplink is of 12.75 to 14.8 GHz and downlink of 10.7 to 12.3 GHz. This band may be extensively used in future. A third band is the 20/30 GHz band where 2.5 GHz bandwidth has been allocated with a uplink of 27.5 to 31 GHz and downlink of 18.1 to 21.2 GHz. Some of the advantages and disadvantages of 6/4 GHz are given below: Advantages of 6/4 GHz Band: In this band there is no absorption by the rain. It has the fewest propagation problems. Attenuation is low below 10 GHz at an elevation angle of 5° or more. There is no change of polarization when the waves pass through ionosphere. RF components for these band were being used for terrestrial relay links also and hence were available easily. Sky noise is low at 4 GHz and therefore signal-to-noise ratio at the receiving antenna is not much deteriorated. Broad beam width allowed large area coverage for receiving. It is easier to generate high power at 4 GHz at the satellite than at 11 GHz. Disadvantages of 6/4 GHz Band: Bandwidth is limited to 500 MHz which can be extended to 1,000 MHz at the most by using orthogonal polarization scheme. Interference from other users is more. The band is rather congested. Power cannot be concentrated in very small area on the earth. Higher frequencies can produce narrower beams. Direct reception in home TVs is not easily possible because of the need of big sized parabolic dishes. Higher bands are required for the same. Reasons for the Downlink Frequency to be Lower than the Uplink Frequency Frequency of downlink is smaller than that of the uplink, several factors are there such as Output power amplifier in transponder : It is the most important factor because the final power amplifier in the transponder generates more power at lower frequencies than at higher frequencies. Effective area of the receiving antenna : The effective capture area of the downlink antenna should be more so as to receive more energy at the earth's receiving antenna. Effective area of an antenna is directly proportional to the square of the frequency. Thus, the frequency should be kept lower. Path loss : It is less at lower frequencies than at higher frequencies. Beamwidth : It should be wider as a satellite would send energy to a large number of earth stations. Lower the frequency wider is the beamwidth. The basic block diagram of an earth station transmitter is shown in Fig. 24.8. The baseband signal from the terrestrial network is processed through encoder and modulator, then it is converted to uplink frequency. Finally it is amplified by high power amplifier and directed towards the appropriate part of antenna. The block diagram of an earth station receiver is shown in Fig. 24.9. The signal received from the satellite is processed through low noise amplifier and then it is down converted, demodulated by demodulator and decoded by decoder. Thus the original baseband signal is obtained. In case of failure to maintain uninterruptable power some critical components will he installed with automatic switch over. The isolation of high power amplifier and low noise amplifier is of much concern in the design considerations of an earth station. Some mutual interference effects may be there and these includes interference caused by side lobes if antenna interferes with an adjacent satellite or an earth station equipment. Other sources of interference are microwave relay links, sun transit and intermodulation produces generated in the transponder. Before 1983 the spacing between the two geostationary satellites was 4° of an equatorial arc and the smallest earth station antenna diameter was 5 m. Nowadays the spacing allowed between two adjacent satellite in space is 2° along the equatorial arc. The closer spacing has allowed twice as many satellite to occupy the same orbital arc, so nowadays every earth station antenna is designed accordingly. Advantages and Disadvantages of Satellite Communication System: Communication through satellite has several advantages and disadvantages. Until the evolution of satellite communication system, long distance communication through space could be done by using cascaded radio relays, very low frequency (below 30 kHz) and high frequency or short waves radio (3-30 MHz). But the cascaded radio relays were limited to overland spans. So the satellite has given a major contribution in the field of communication, capable of transmitting high capacity over long distances either overland or water. Also because of its unique geometry, it is inherently a broadcast medium with a natural ability to transmit simultaneously from one point to an arbitrary number of other points within its converge area. Advantages: Point to multipoint communication is possible whereas terrestrial relays are point-to-point. This is because satellite relays are wide area broadcast. Circuits for the satellite can be installed rapidly. Once the satellite is in position, earth stations can be installed and communication may be established within some days or even hours. During critical conditions each earth stations may be removed relatively quickly from a location and reinstalled somewhere else. Mobile communications can be easily achieved by the satellite communication system because of its flexibility in interconnecting mobile vehicles. Satellite communication system has the economical advantage that the satellite costs are independent of the distance. As compared to fibre optic cable, the satellite communication system has the advantage that the quality of transmitted signals and the location of stations, sending and receiving information is independent of distance. Disadvantages: With the satellite in position the communication path between the terrestrial transmitter and the receiver is approximately 75,000 km long (twice the distance of geostationary orbit from earth). There is a delay of 1/4 second between the transmission and reception of a signal because the velocity of electromagnetic wave is 3 x 105 km/second. Thus between talks there is an elapse of 1/2 second and one may feel it annoying. This delay produces echo which is actually caused by an imperfect impedance matching. The time delay reduces the efficiency of satellite in data transmission and long file transfer which carried out over the satellites. Overcrowding of available bandwidths due to low antenna gains. High atmospheric losses above 30 GHz limit carrier frequencies. The utilization of Satellite Communication worldwide has become common and everywhere in some different applications such as DTH Broadcasting, Television, DSNG, and VSAT to develop unique facilities in terms of outreach as well as coverage. For the past three decades, this technology is used in a large number of commercial as well as common applications. The prospective of the technology for public applications continues to attract ISRO & hard works are influencing the benefits of technology for the betterment of mankind. Significant proposals followed by ISRO to societal growth comprise telemedicine, education, DMS (Disaster Management System) & VRC (Village Resource Centre) programs. The space technology potential for national development applications is vast. The world's first artificial satellite was launched by the Soviet Union namely Sputnik-1 in the year 1957. After eighteen 18 years, an artificial satellite like Aryabhata was launched by India in the year 1975. What is Satellite Communication? A satellite definition is a small object that rotates in the region of a larger object within space. The best example of a natural satellite of the globe is the moon. We know that communication is nothing but the sharing of data among two or more entities using any transmission channel or medium. Alternatively, communication can also be defined as transmitting, receiving & processing the data. So, if communication occurs between any two stations on the earth with a satellite, then it is known as satellite communication. In this kind of communication, electromagnetic waves are utilized like carrier signals to carry the data like audio, voice, video among space and ground. Need of Satellite Communication In earlier communication, there are two types of propagation is used up to some distance like ground wave propagation and skywave propagation. The bandwidth used by Ground wave propagation is up to 30MHz frequencies. This kind of communication uses the conditions of the troposphere of the globe. The bandwidth used by skywave propagation mainly ranges from 30 to 40 MHz with the properties of the ionosphere of the earth. The highest station distance is restricted to 1500KM simply in both the propagations. So, satellite communication conquers this drawback. By providing long-distance communication. Satellite Communication Working As the satellites situate at a certain height from the earth, then communication occurs in between two earth stations simply through satellite. So, it conquers the drawback of communication between two stations on the earth because of the curvature of the earth. Block Diagram Satellite communications are related to the space mirrors because they assist us in activating the signals like internet data, radio & TV from one face of the earth to another face. The block diagram of the satellite communication system includes the following. This satellite communication system can be explained through three blocks namely uplink, transponder, and downlink where these components of the satellite communication system & their working are discussed below. Block Diagram of Satellite Communication Let us consider the signals from a TV. In the primary phase, the signal transmits from the television to the other face of the earth & first carries to the satellite from the earth station over the earth. So this kind of procedure is called an uplink. The second stage is transponder like amplifiers, transmitters & radio receivers. The main function of a transponder is to boost the inward signal as well as to modify its frequency so that the leaving signals are not changed. Based on the incoming sources of signal, the transponder will change. The final stage includes a downlink where the data is transmitted to the receiver on the globe. It is significant to recognize that generally there is a single uplink & several downlinks. Types of Satellite Communication The classification of satellites can be done based on their functions because they are mainly launched into space to perform a specific task. So its design must fulfill its role. There are different types of satellite communication systems like communication, remote sensing, navigation, geocentric orbit type like LEO, HEO, MEO, GPS (global positioning system), GEOs(geostationary satellites), polar, ground, drone, smallsats, CubeSats, nanosats. From the above-mentioned types of satellites, the satellite communication type because they receive signals which are received from earth station & again transmit to other earth station. Satellite communication systems are classified into two categories like one-way satellite communication & two-way satellite communication. One-way Satellite Communication In this kind of communication, usually, the communication occurs between either one earth station or several earth stations through a satellite like the transmitter of the first earth station sends the data to the receiver of the second earth station. Here the direction of signal transmission is unidirectional. So some frequently used one-way satellite communication are Position services supplied by the radio Tracking is an element of space operations services Internet services occur through broadcasting satellites Two-way Satellite Communication In this kind of communication, the exchange of data can be done between any two earth stations by a satellite. The transmission of a signal can be done from the primary earth station to the next earth station so that there are two uplinks & downlinks that occur among the satellite & earth stations. The communication services provided by the satellites are telecommunications, broadcasting, & data communications. Telecommunication services are telephone calls as well as different services provided to various telephone companies & mobile, wireless & mobile network providers. Broadcasting services provided by TV & radio to the consumer are mobile broadcasting services whereas satellite TV or DTH services are received by households directly. Data communications are used to transmit the data from one end to another. In various organizations, the information can be exchanged in between different locations which utilize satellites to assist the data transfer through the network. With the development of the internet, a major quantity of internet traffic travels throughout satellites to make the Internet service providers one of the main customers for satellite services. Factors Affecting Performance The satellite system performance is mainly associated with the radio signal's type & its strength used among the satellite & transmitter mounted through the vessel. The interrelated factors which determine the power requirements, as well as the size of the vessel transmitter, are power accessible within the satellite system & the level where the satellite can focus on a geographical region. The radio signal type used by transmitters is related to monitoring control & surveillance of fisheries in the microwave band is extremely reliable & fairly low-powered. The signal is not highly affected through the conditions of atmospheric. Advantages The advantages of satellite communication include the following. Circuit connections are simple The circuit elasticity is outstanding. The network can be controlled by the user. Possibilities of broadcasting and more bandwidth Each corner of the globe can be covered by using a satellite communication system. Transmission cost is independent for coverage region Coverage area is more as compared to the terrestrial systems Disadvantages The disadvantages of satellite communication system include the following. A satellite launching into orbit is an expensive procedure. Satellite bandwidth is reducing as compared to conventional terrestrial systems. More free space loss Initial expenditure is costly. Propagation & interference. If any issue happens within a satellite system then providing repairing activities is difficult. Applications The applications of satellite communication system include the following. TV Telephone Monitoring of Weather Condition and Forecasting Military Navigations Amateur Radio TV broadcasting like DTH (Direct to Home) Radio Broadcasting Remote sensing applications Disaster Management Voice communications & Radio Broadcasting Internet Access Digital cinema Internet applications to provide the application of internet connection for GPS applications, data transfer, Internet surfing, and many more. Please refer to this link to know more about GPS MCQs. Please refer to this link to know more about Digital Communication MCQs & Mobile Communication MCQs. Thus, satellite communication systems are used in vessels, where normally mobiles do not work properly so satellite phones are useful in communication. Satellite phones, satellite TV, radio, and the internet can operate on the principle of satellite communication. So this kind of communication is mainly useful in remote regions wherever the facilities of broadband do not work properly. Here is a question for you, what are the different radio frequency bands used by commercial satellites? Satellite communication is a critical component of modern communication infrastructure, enabling long-distance data transmission, broadcasting, navigation, and global connectivity. This guide provides an in-depth look at satellite communication, including the fundamentals of satellites, types of satellites including geosynchronous and geostationary, network architecture, frequency bands, orbits, applications and more. What is a Satellite? A satellite is an artificial object intentionally placed into orbit around the Earth or another celestial body. Satellites serve various purposes, including communication, weather monitoring, navigation, and scientific research. In satellite communication, these orbiting devices act as relay stations that receive signals from Earth, amplify them, and transmit them back to different locations. In a C-Band satellite system, a ground station or VSAT transmits at 6 GHz. The satellite receives this 6 GHz signal and translates it to 4 GHz using an on-board LO of frequency 2225 MHz. A hub or Earth station houses an antenna with sizes from 7.5 to 11.2 meters. VSAT houses an antenna of 3.7 or 4.2 meters in size. A satellite usually will have 12 transponders having 36 MHz bandwidth each. For C band satellites, the uplink frequency is within the 5925 to 6425 MHz range, whereas the downlink frequency is within the 3700 to 4200 MHz range. For Ku band satellites, the uplink is 14 to 14.5GHz whereas the downlink is from 11.45 to 11.7 GHz range. Typical specifications of a communication satellite are as follows: Frequency band of operation: C band uplink frequency: 6 GHz Downlink frequency: 4 GHz Input Carrier saturation flux density: -85 dBW/meter*meter Input carrier backoff: -10dB G/T of satellite antenna receive : -5 dB/deg.K Single carrier saturated flux density output: 32 dBW Output backoff: 4.5 dB Uplink path loss : 199.6 dB Downlink Path loss: 196.0 dB Satellite Intermodulation noise density : -100 dB/Hz Geosynchronous and Geostationary Satellites Geosynchronous Satellites: This is a satellite which has an orbital period matching Earth's rotation, causing it to return to the same spot in the sky each day. Examples: Spy satellites, Scientific satellites. Geostationary Satellite: A geostationary satellite is a type of geosynchronous satellite that has a circular orbit directly above the Earth's equator, allowing it to remain fixed over one point on the Earth's surface. The circular orbit is situated at the altitude of 35768 Kms above the equator of the Earth. Examples: Communications satellites, Weather satellites, Navigation Satellites. Types of Satellites Satellites are categorized based on their function, orbit, and operational purpose. The main types include following. Communication Satellites: Used for telecommunication, broadcasting, internet services, and more. Examples: Intelsat, Eutelsat. Weather Satellites: Monitor atmospheric conditions, provide weather forecasts, and track storms. Examples: NOAA, GOES. Navigation Satellites: Provide positioning and timing information for GPS and other navigation systems. Examples: GPS (USA), GLONASS (Russia), Galileo (EU). Earth Observation Satellites: Used for environmental monitoring, mapping, and disaster management. Examples: Landsat, Copernicus. Scientific Satellites: Conduct space and planetary research. Examples: Hubble Space Telescope, James Webb Space Telescope. Military Satellites: Used for surveillance, reconnaissance, and secure communication. Examples: Keyhole series, MILSTAR. Frequency Bands in Satellite Communication Satellite communication utilizes specific frequency bands to avoid interference and ensure clear signal transmission. Common frequency bands are mentioned in the following table. BandFrequency RangeUse or applicationL-Band1-2 GHzUsed for GPS, mobile satellite phones and maritime communicationS-Band2-4 GHzEmployed in weather satellites and some mobile communications.C-Band4-8 GHzCommon in satellite TV broadcasting and data transmission, known for its resistance to rain fade.X-Band8-12 GHzUsed primarily for military and government applications.Ku-Band12-18 GHzWidely used for satellite TV, VSAT networks and internet services.K-Band18-26.5 GHzUsed for high resolution satellite imagery and some communication services.Ka-Band26.5-40 GHzOffers high data rates, suitable for high-speed internet, broadband services and emerging applications in 5G networks due to its large available bandwidth. The Ka-Band supports high-capacity satellite links, making it ideal for delivering broadband services to consumers, businesses, and mobile platforms. Satellite Network Architecture In a satellite based wireless system, information (voice, data, image, video) is transmitted using microwave radio frequency using a parabolic antenna. Following are the topologies supported in satellite communication. Point-to-Point: Direct communication between two ground stations via a satellite. Point-to-Multipoint: A single ground station broadcasts to multiple receivers. As shown in the figure, satellite based internet uses the same topology. Mesh Topology: Ground stations communicate directly through a satellite without the need for a central hub. Satellite communication relies on a network architecture that includes the following key components: Space Segment: Comprises the satellite itself, which contains transponders to receive, amplify and retransmit signals. Ground Segment: Consists of Earth stations (ground-based antennas) that communicate with the satellite. These stations are responsible for transmitting data to the satellite and receiving data from it. User Segment: Includes the end-user devices like satellite phones, TV dishes, and GPS receivers that access satellite services. There are two modes of satellite based network architecture viz. mesh and star. In mesh mode, VSAT1 and VSAT2 directly communicate using satellite. In star mode, VSAT1 and VSAT2 communicates using satellite/Hub Station. Applications of Satellite Communication Satellite communication plays a vital role in various sectors: Telecommunication: Provides backbone connectivity for telephone networks, especially in remote areas. Broadcasting: Delivers television and radio programming through Direct-to-Home (DTH) systems. Internet Connectivity: Offers broadband internet services in rural and underserved regions via satellite ISPs. Navigation and GPS: Supports global navigation systems that enable precise location tracking and timing. Disaster Management: Provides emergency communication and real-time data during natural disasters, aiding rescue and relief operations. Military and Defense: Ensures secure, reliable communication for defense operations and intelligence gathering. Remote Sensing: Facilitates Earth observation for agriculture, forestry, environmental monitoring, and urban planning. Advantages of Satellite Communication The satellite communication advantages are as follows. Global Coverage: Satellites can provide communication services to any location on Earth, including remote and inaccessible areas. Scalability: Easily scalable to increase coverage and capacity without significant ground infrastructure. Reliability: Less susceptible to natural disasters which usually affects terrestrial networks. Challenges in Satellite Communication The satellite communication challenges or limitations are as follows. High Initial Costs: Launching and maintaining satellites is expensive. Signal Latency: As the signals travel longer distances, geostationary satellites introduce significant amount of delay. Interference: Weather conditions like heavy rain can cause signal degradation, especially in higher frequency bands. Future of Satellite Communication The future of satellite communication is poised for growth with advancements in technology: Low Earth Orbit (LEO) Satellites: Promises reduced latency and enhanced global broadband coverage (e.g., SpaceX's Starlink, OneWeb). Due to this, LEO satellites find applications in IoT (Internet of Things) applications. 5G Integration: Satellites are expected to play a critical role in supplementing 5G networks, especially in remote areas. Enhanced Data Rates: New frequency bands and improved satellite technology will continue to drive higher data rates and network efficiency. Satellites play a crucial role in the integration of 5G and IoT networks by providing widespread and reliable connectivity, especially in remote and underserved areas where traditional terrestrial networks are impractical. This is achieved through Low Earth Orbit (LEO) satellite constellations that offer low latency and high speed communication. In the realm of IoT, satellites enable the connection of devices across vast and hard-to-reach locations, by providing ubiquitous and continuous network access. Technology The Web & Communication satellite communication, in telecommunications, the use of artificial satellites to provide communication links between various points on Earth. Approximately 2,000 artificial satellites orbiting Earth relay analog and digital signals carrying voice, video, and data to and from one or many locations worldwide.Satellite communication has two main components: the ground segment, which consists of fixed or mobile transmission, reception, and ancillary equipment, and the space segment, which primarily is the satellite itself. A typical satellite link involves the transmission or uplinking of a signal from an Earth station to a satellite. The satellite then receives and amplifies the signal and retransmits it back to Earth, where it is received and reamplified by Earth stations and terminals. Satellite receivers on the ground include direct-to-home (DTH) satellite equipment, mobile reception equipment in aircraft, satellite telephones, and handheld devices. Satellites: Artificial satellites orbiting the Earth, equipped with transponders for receiving, amplifying, and re-transmitting signals.Ground Stations: Earth-based facilities equipped with antennas and transceivers for transmitting and receiving signals to and from satellites.User Terminals: Devices used by end-users to communicate with satellites, such as satellite phones, satellite TV receivers, and VSAT (Very Small Aperture Terminal) systems.2. Functioning Principles of Satellite Communication SystemsSatellite communication systems operate based on the following principles:Uplink: The transmission of signals from ground stations to satellites. Ground stations transmit signals to satellites using specific frequency bands allocated for uplink communication.Transponder: A critical component of a satellite that receives signals from ground stations, amplifies them, and retransmits them back to Earth. Transponders are equipped with antennas and electronic circuitry to process incoming and outgoing signals.Downlink: The transmission of signals from satellites to ground stations or directly to user terminals. Satellites transmit signals to designated ground stations or directly to user terminals within their coverage areas.3. Types of SatellitesSatellites used in communication systems can be categorized into different types based on their orbits and applications:Geostationary Satellites: Positioned in geostationary orbit approximately 35,786 kilometers above the Earth's equator, these satellites remain stationary relative to the Earth's surface. They provide continuous coverage to specific regions and are ideal for applications requiring constant connectivity, such as television broadcasting and weather monitoring.Low Earth Orbit (LEO) Satellites: Orbiting at altitudes ranging from 160 to 2,000 kilometers, LEO satellites offer lower latency and higher data rates compared to geostationary satellites. They are commonly used for global internet coverage, earth observation, and remote sensing applications.Medium Earth Orbit (MEO) Satellites: Positioned at altitudes ranging from 2,000 to 35,786 kilometers, MEO satellites offer a balance between coverage area and latency. They are often used in navigation systems such as GPS (Global Positioning System).4. Applications of Satellite Communication SystemsSatellite communication systems find applications across various sectors, including:Telecommunications: Providing voice, data, and video communication services to remote areas, maritime vessels, and aircraft where terrestrial infrastructure is limited or unavailable.Broadcasting: Delivering television and radio programming to global audiences via satellite broadcasting.Navigation: Facilitating precise positioning and navigation services through systems like GPS and Galileo.Remote Sensing: Collecting data on Earth's surface, atmosphere, and oceans for environmental monitoring, weather forecasting, and natural disaster management.Military and Defense: Supporting secure communication, surveillance, reconnaissance, and intelligence gathering activities.5. Future Trends and InnovationsThe future of satellite communication systems is marked by advancements in technology and the emergence of new applications. Some notable trends and innovations include:High Throughput Satellites (HTS): Satellites equipped with advanced digital payload technology to deliver higher data throughput and capacity.Satellite Constellations: Deployment of large constellations of small satellites in LEO to provide global internet coverage with low latency and improved reliability.Inter-Satellite Links (ISL): Direct communication links between satellites to enable efficient data relay and routing, reducing reliance on ground stations.Laser Communication: Implementation of laser communication systems for high-speed data transmission between satellites and ground stations, offering increased bandwidth and security.ConclusionSatellite communication systems play a crucial role in enabling global connectivity and serving diverse applications ranging from telecommunications and broadcasting to navigation and remote sensing. Understanding the basics, functioning principles, and applications of satellite communication systems is essential for leveraging their capabilities and driving innovation in the telecommunications industry. As technology continues to evolve, satellite communication systems are poised to play an even more significant role in shaping the future of connectivity on a global scale.

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