**Galileo** is a [global navigation satellite system](https://en.wikipedia.org/wiki/Satellite_navigation) (GNSS) created by the [European Union](https://en.wikipedia.org/wiki/European_Union) through the [European Space Agency](https://en.wikipedia.org/wiki/European_Space_Agency) (ESA) and operated by the [European Union Agency for the Space Programme](https://en.wikipedia.org/wiki/European_Union_Agency_for_the_Space_Programme) (EUSPA).[[6]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-6) It is headquartered in [Prague](https://en.wikipedia.org/wiki/Prague) in [Czechia](https://en.wikipedia.org/wiki/Czech_Republic),[[7]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-7) with two ground operations centres in [Oberpfaffenhofen](https://en.wikipedia.org/wiki/Oberpfaffenhofen), [Germany](https://en.wikipedia.org/wiki/Germany) (mostly responsible for the control of the satellites), and in [Fucino](https://en.wikipedia.org/wiki/Fucine_Lake), [Italy](https://en.wikipedia.org/wiki/Italy) (mostly responsible for providing the navigation data).[[8]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-8) The €10 billion project began offering limited services in 2016.[[5]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-BREXIT-5)[[9]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-9)[[10]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-:2-10) It is named after the Italian astronomer [Galileo Galilei](https://en.wikipedia.org/wiki/Galileo_Galilei).

One of the aims of Galileo is to provide an independent high-precision positioning system so European political and military authorities do not have to rely on the United States [GPS](https://en.wikipedia.org/wiki/Global_Positioning_System) or the Russian [GLONASS](https://en.wikipedia.org/wiki/GLONASS) systems, which could be disabled or degraded by their operators at any time.[[11]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-11) The use of basic (lower-precision) Galileo services is free and open to everyone. A higher-precision service is available for free since 24 January 2023, previously only available to government-authorized users.[[12]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-12)[[13]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-13) Galileo is also to provide a new global [search and rescue](https://en.wikipedia.org/wiki/Search_and_rescue) (SAR) function as part of the [MEOSAR system](https://en.wikipedia.org/wiki/International_Cospas-Sarsat_Programme#MEOSAR).

The second Galileo test satellite [GIOVE-A](https://en.wikipedia.org/wiki/GIOVE-A) was launched 28 December 2005, while the [first satellite](https://en.wikipedia.org/wiki/List_of_Galileo_satellites) to be part of the operational system was launched on 21 October 2011. Galileo started offering Early Operational Capability (EOC) on 15 December 2016,[[1]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-operational-1) providing initial services with a weak signal.[[14]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-14) In October 2018, four more Galileo satellites were brought online, increasing the number of active satellites to 18.[[15]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-15) In November 2018, the [FCC](https://en.wikipedia.org/wiki/Federal_Communications_Commission) approved use of Galileo in the [US](https://en.wikipedia.org/wiki/United_States).[[16]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-16) As of September 2024, there are 25 [launched satellites](https://en.wikipedia.org/wiki/List_of_Galileo_satellites#Satellites) that operate in the constellation.[[17]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-17)[[18]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-First_Pair-18)[[19]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-19) It is expected that the next generation of satellites will begin to become operational after 2026 to replace the first generation, which can then be used for backup capabilities. Most satellites of the programme were built by [OHB](https://en.wikipedia.org/wiki/OHB) in Bremen, Germany, with the contribution of Surrey Satellite Technology (SSTL) in Guildford, United Kingdom.[[20]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-eoportal-20)[[21]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-batch_3-1-21)[[22]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-batch_3-2-22)[[23]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-23)[[24]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-12_things-24)

The Galileo system has a greater accuracy than [GPS](https://en.wikipedia.org/wiki/Global_Positioning_System), having an accuracy of less than 1 m when using broadcast ephemeris (GPS: 3 m)[[25]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-25) and a signal-in-space ranging error (SISRE) of 1.6 cm (GPS: 2.3 cm) when using real-time corrections for satellite orbits and clocks.[[26]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-26)[[27]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-27)

**History**

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The headquarters of the [EUSPA](https://en.wikipedia.org/wiki/European_Union_Agency_for_the_Space_Programme), which operates the Galileo system, in [Prague](https://en.wikipedia.org/wiki/Prague)

**Main objectives**

In 2008, the different concepts of the three main contributors of the [European Space Agency](https://en.wikipedia.org/wiki/European_Space_Agency) (ESA) (Germany, France and Italy)[[28]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-28) for Galileo were compared and reduced to one by a joint team of engineers from all three countries. The first stage of the Galileo programme was agreed upon officially on 26 May 2003 by the [European Union](https://en.wikipedia.org/wiki/European_Union) and the ESA. The system is intended primarily for civilian use, unlike the more military-focused systems of the United States ([GPS](https://en.wikipedia.org/wiki/Global_Positioning_System)), Russia ([GLONASS](https://en.wikipedia.org/wiki/GLONASS)) and China ([BeiDou](https://en.wikipedia.org/wiki/BeiDou)) in that Galileo doesn't limit accuracy for non-military applications.[[29]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-29)[[30]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-30) The European system could be subject to shutdown for military purposes in extreme circumstances (such as an armed conflict).[[31]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-dublin.usembassy.gov-31) Italy and Germany led the development of the first generation of the Galileo programme,[[32]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-32) while France is playing a more prominent role in the development of the Galileo Second Generation (G2G).[[33]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-33)[[34]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-sattoday-ecawardsg2contractthales-34)[[35]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-FOC_gen_2-4-35)

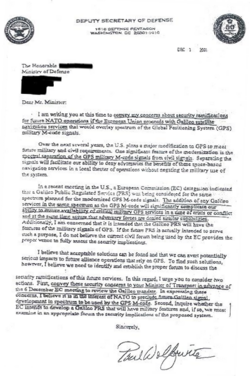
**Funding**

The [European Commission](https://en.wikipedia.org/wiki/European_Commission) had some difficulty funding the project's next stage, after several allegedly "per annum" sales projection graphs for the project were exposed in November 2001 as "cumulative" projections, which for each year projected included all previous years of sales. The attention that was brought to this multi-billion euro growing error in sales forecasts resulted in a general awareness in the commission and elsewhere that it was unlikely that the programme would yield the [return on investment](https://en.wikipedia.org/wiki/Return_on_investment) that had previously been suggested to investors and decision-makers.[[36]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-36)[[*better source needed*](https://en.wikipedia.org/wiki/Wikipedia:NOTRS)] On 17 January 2002, a spokesman for the project stated that, as a result of US pressure and economic difficulties, "Galileo is almost dead".[[37]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-37)

A few months later, however, the situation changed dramatically. European Union member states decided it was important to have a satellite-based positioning and timing infrastructure that the US could not easily turn off in times of political conflict.[[38]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-Johnson_2007-38)

The European Union and the European Space Agency agreed in March 2002 to fund the project, pending a review in 2003 (which was completed on 26 May 2003). The starting cost for the period ending in 2005 is estimated at €1.1 billion. The required satellites (the planned number is 30) were to be launched between 2011 and 2014, with the system up and running and under civilian control from 2019. The final cost is estimated at €3 billion, including the infrastructure on [Earth](https://en.wikipedia.org/wiki/Earth), constructed in 2006 and 2007. The plan was for private companies and investors to invest at least two-thirds of the cost of implementation, with the EU and ESA dividing the remaining cost. The base *Open Service* is to be available without charge to anyone with a Galileo-compatible [receiver](https://en.wikipedia.org/wiki/Receiver_(radio)), with an encrypted higher-bandwidth improved-precision *Commercial Service* originally planned to be available at a cost, but in February 2018 the high accuracy service (HAS) (providing [Precise Point Positioning](https://en.wikipedia.org/wiki/Precise_Point_Positioning) data on the E6 frequency) was agreed to be made freely available, with the authentication service remaining commercial.[[39]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-39) By early 2011 costs for the project had run 50% over initial estimates.[[40]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-costoverruns-40)

**Tension with the United States**

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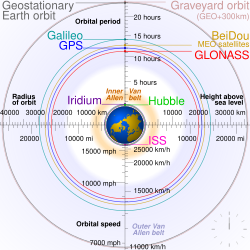
A December 2001 letter from [US Deputy Secretary of Defense](https://en.wikipedia.org/wiki/United_States_Deputy_Secretary_of_Defense) [Paul Wolfowitz](https://en.wikipedia.org/wiki/Paul_Wolfowitz) to the [Ministers](https://en.wikipedia.org/wiki/Minister_(government)) of the [EU states](https://en.wikipedia.org/wiki/Member_State_of_the_European_Union), pointing out possible compatibility issues

Galileo is intended to be an EU civilian GNSS that allows all users access to it. Initially [GPS](https://en.wikipedia.org/wiki/GPS) reserved the highest quality signal for military use, and the signal available for civilian use was intentionally degraded ([Selective Availability](https://en.wikipedia.org/wiki/Selective_Availability)). This changed with President [Bill Clinton](https://en.wikipedia.org/wiki/Bill_Clinton) signing a policy directive in 1996 to turn off Selective Availability. Since May 2000 the same precision signal has been provided to both civilians and the military.[[41]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-41)

Since Galileo was designed to provide the highest possible precision (greater than GPS) to anyone, the US was concerned that an enemy could use Galileo signals in military strikes against the US and its allies (some weapons like missiles use GNSSs for guidance). The frequency initially chosen for Galileo would have made it impossible for the US to block the Galileo signals without also interfering with its own GPS signals.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] The US did not want to lose their GNSS capability with GPS while denying enemies the use of GNSS. Some US officials became especially concerned when Chinese interest in Galileo was reported.[[42]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-42)

An anonymous EU official claimed that the US officials implied that they might consider shooting down Galileo satellites in the event of a major conflict in which Galileo was used in attacks against American forces.[[43]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-43)[[*failed verification*](https://en.wikipedia.org/wiki/Wikipedia:Verifiability)]The EU's stance is that Galileo is a neutral technology, available to all countries and everyone. At first, EU officials did not want to change their original plans for Galileo, but they have since reached the compromise that Galileo is to use different frequencies. This allows the blocking or jamming of either GNSS without affecting the other.[[44]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-44)

**GPS and Galileo**

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Clickable image, highlighting [medium altitude orbits around Earth](https://en.wikipedia.org/wiki/Medium_Earth_Orbit),[[a]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-45) from [Low Earth](https://en.wikipedia.org/wiki/Low_Earth_orbit) to the lowest [High Earth orbit](https://en.wikipedia.org/wiki/High_Earth_orbit) ([geostationary orbit](https://en.wikipedia.org/wiki/Geostationary_Earth_orbit) and its [graveyard orbit](https://en.wikipedia.org/wiki/Graveyard_orbit), at one ninth of the [Moon's orbital distance](https://en.wikipedia.org/wiki/Lunar_distance)),[[b]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-46) with the [Van Allen radiation belts](https://en.wikipedia.org/wiki/Van_Allen_radiation_belt) and the [Earth](https://en.wikipedia.org/wiki/Earth) to scale

One of the reasons given for developing Galileo as an independent system was that position information from GPS can be made significantly inaccurate by the deliberate application of universal [selective availability](https://en.wikipedia.org/wiki/Error_analysis_for_the_Global_Positioning_System) (SA) by the US military. GPS is widely used worldwide for civilian applications; Galileo's proponents argued that civil infrastructure, including aircraft navigation and landing, should not rely solely upon a system with this vulnerability.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

On 2 May 2000, the selective availability was disabled by the President of the United States, [Bill Clinton](https://en.wikipedia.org/wiki/Bill_Clinton); in late 2001 the entity managing the GPS confirmed that it did not intend to enable selective availability ever again.[[45]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-47) Though Selective Availability capability still exists, on 19 September 2007 the US Department of Defense announced that newer GPS satellites would not be capable of implementing Selective Availability;[[46]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-48) the wave of [Block IIF](https://en.wikipedia.org/wiki/GPS_Block_IIF) satellites launched in 2009, and all subsequent GPS satellites, are stated not to support selective availability. As old satellites are replaced in the [GPS Block III](https://en.wikipedia.org/wiki/GPS_Block_III) programme, selective availability will cease to be an option.[[47]](https://en.wikipedia.org/wiki/Galileo_(satellite_navigation)#cite_note-49) The modernisation programme also contains standardised features that allow GPS III and Galileo systems to inter-operate, allowing receivers to be developed to utilise GPS and Galileo together to create an even more accurate GNSS.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]