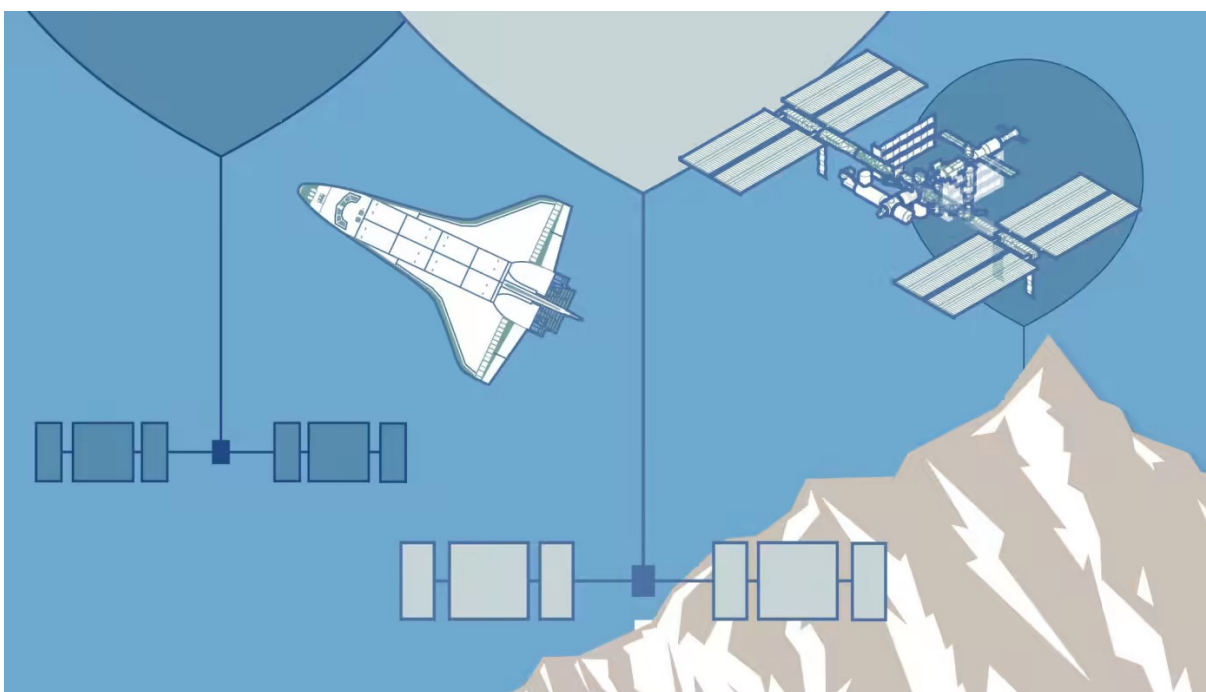


Science

Spy balloons, sky clutter and UFOs: what flies in the 'forgotten space'?

Objects in the upper stratosphere are used for science, surveillance and communications



The ‘forgotten space’ between about 15km and 40km above the Earth’s surface is sometimes called near space © FT montage

Clive Cookson and **Ian Bott** in London 9 HOURS AGO

The layer of sky above the cruising height of commercial aircraft and below satellite orbits was, until recently, regarded by most people to be empty space.

That changed after a gigantic Chinese balloon [drifted across North America](#) 20km above the ground, followed by three more mysterious objects with lower altitude flight paths, which were all [shot down](#).

The “forgotten space” between about 15km and 40km above the Earth’s surface — sometimes called near space — is well suited to longer-lasting surveillance balloons, said professor Alan Woodward, a physicist and security expert at the University of Surrey.

“The Chinese are not the only ones doing this,” said Woodward. “The Americans realised long ago that high-altitude balloons were a ‘sweet spot’ for intelligence gathering.” The US operated a balloon surveillance programme called [Project Genetrix](#) over the Soviet Union in the 1950s.

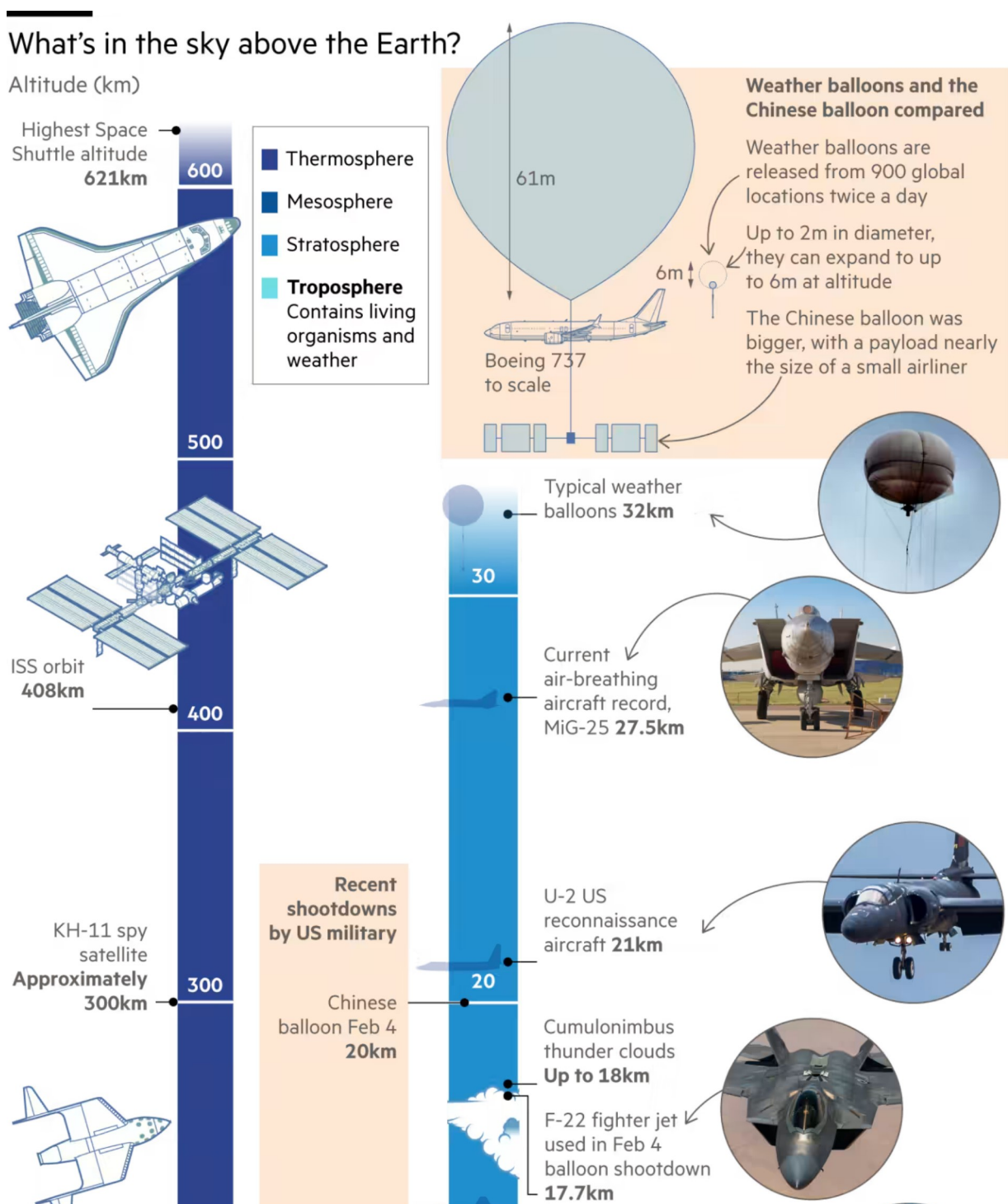
But spy balloons are not the most common objects in this part of the atmosphere. So what else flies in the “forgotten space” above our heads?

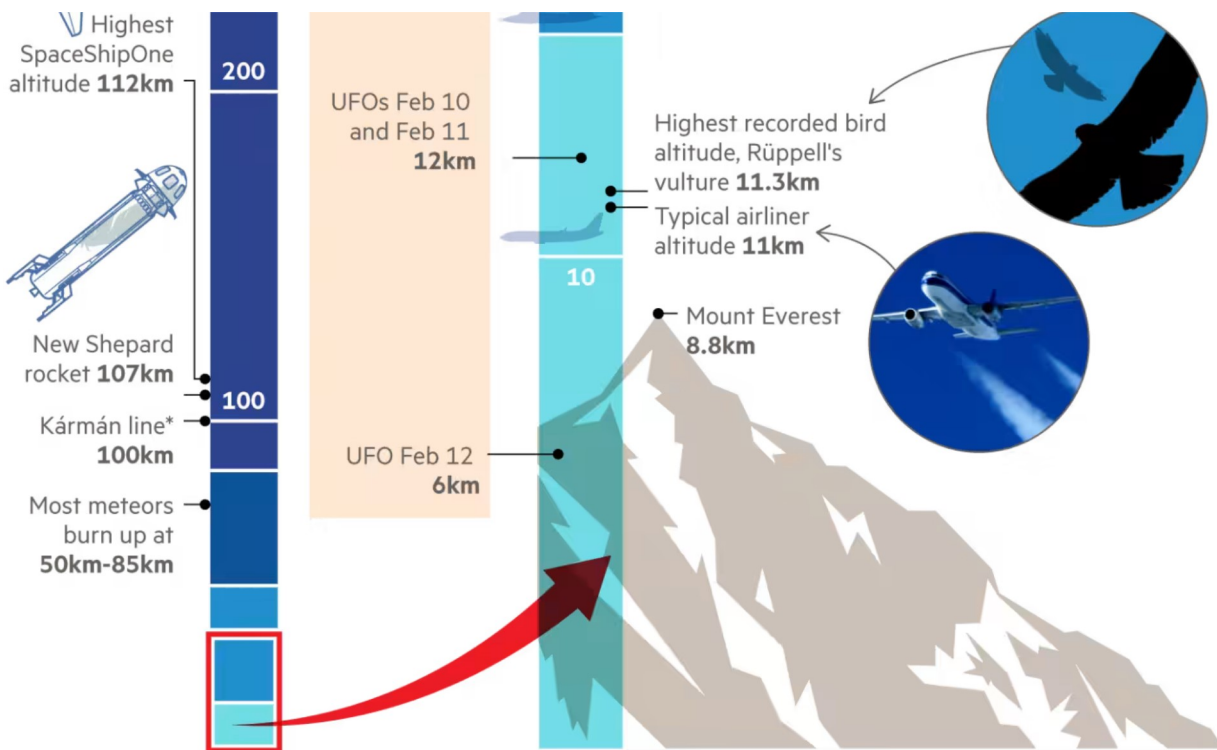
Weather and scientific balloons

weather and scientific balloons

The objects that penetrate the upper stratosphere most frequently are weather balloons carrying instruments called radiosondes that transmit readings of pressure, temperature and humidity. They provide meteorologists with an invaluable profile of conditions through the atmosphere up to 36km.

According to the US National Weather Service, weather balloons are released twice a day from almost 900 locations worldwide – amounting to more than 600,000 launches per year.





* FAI-defined boundary between Earth's atmosphere and space
 Sources: Nasa; USAF; DoD; National Weather Service; StratoStar; FAI; FT research
 © FT

Helium-filled weather balloons are relatively small, starting out at about 2m wide and expanding to 6m as atmospheric pressure falls while they ascend. After rising for an hour or so, the thin rubber membrane bursts and the radiosonde descends gently on a small parachute. About 20 per cent of weather balloons sent up every year from the US are later found on the ground and returned for re-use.

All launches are registered with local air traffic control so they pose no risk to aviation, said Oli Claydon of the UK Met Office. “Radiosondes are an essential source of meteorological data and are used around the world to provide accurate observations of the atmosphere to improve weather forecasts,” he said.

Weather balloons were sometimes enhanced for other scientific purposes, said Giles Harrison, professor of atmospheric physics at the University of Reading. “For example, we have developed ways of using them for measuring turbulence, energetic particles from space and electric charge in clouds and deployed them during the 2010 volcanic ash crisis to detect ash in the atmosphere,” he added.

Surveillance balloons

Surveillance balloons are often equipped to image the ground below and pick up

communications and electronic intelligence. In contrast to the quick rise and fall of conventional weather balloons, larger craft made of more durable materials can drift at high altitudes for weeks at a time, as the [suspected Chinese spy balloon](#) shot down on February 4 demonstrated.



The same intelligence collecting technologies used on satellites are also available for balloons, said Stilianos Vidalis, deputy head of computer science at the University of Hertfordshire.

“Sensors can collect photos, audio, video and general signals [known as SIGINT],” he said. “From a cyber security perspective, balloons can offer a platform with the appropriate bandwidth and low latency [time for data transfer to the ground] that is not found in high-orbiting satellites.”

The disadvantage of using a balloon for surveillance is that its movements are at the mercy of high level winds. “The jet stream is well understood so their path can be predicted,” said Woodward. But there has been some speculation that China may have miscalculated the path of its balloon across the US.

Communications balloons

Google-parent Alphabet developed a sophisticated guidance system for its Loon project, which aimed to provide internet connectivity from high-altitude balloons. They took advantage of “layered” wind patterns in the stratosphere, with prevailing winds at one altitude varying in speed and direction from those at slightly different altitudes.

By designing a balloon capable of rising or falling to catch a favourable wind, the Loon team aimed to “sail the stratosphere” without propulsion. The project was [discontinued in 2021](#) on commercial grounds though some technology was sold off for further development and a few Loon flights still take place.

Balloons have very different flight paths to planes

A Loon balloon's route over New Mexico, Jan 30 - Feb 2 2023, at 68,000 feet



Several other companies in the US, such as World View and Sierra Nevada Corporation, are developing stratospheric balloons for purposes such as remote

corporation, are developing stratospheric balloons for purposes such as remote sensing and surveillance.

Europe's aerospace giants are focusing on different types of autonomous high-altitude earth observation and communications platforms with electric propulsion. The [Stratobus](#) from Thales Alenia Space is essentially an airship, while Zephyr, which Airbus is spinning out into a separate business, is a drone flying on wings made of solar panels.

“Sky trash” and UFOs

Some reporting has recently used the term “sky trash” to describe the accumulation of objects over our heads. But many scientists say the phrase is misleading because it wrongly suggests an upper atmosphere full of discarded junk. The man-made material up there is likely to still be functional, though its function may be secret.

“To call it trash is an exaggeration,” said Don Pollacco, a physics professor and astronomer at Warwick university. The upper atmosphere holds no equivalent of the space junk that accumulates in orbit from defunct satellites because unwanted materials would not remain aloft for long periods in the stratosphere.

“There will also be a handful of experimental craft but there won't be many of them,” said Pollacco. Balloons and other light materials should not be a hazard to aircraft, he added, because the air flow over the wings would push them out of the way.

As an expert on extrasolar planets orbiting distant stars, Pollacco has been asked whether any of the unidentified objects might have come from an alien culture. “The likelihood of that is about zero per cent,” he said.