

SkyWire™ Technology





Use SkyWire™ Technology to Measure and Verify the Accuracy and Precision of Geographically Distributed Clocks

SkyWire™ technology implements enhanced Positioning, Navigation and Timing (PNT) technology to precisely compare clocks across widely dispersed geographic locations to ensure alignment including traceability with national time standards

SkyWire™ Technology Delivers Precise and Scalable Clock Comparisons Across Global Networks

Using a nontraditional method of leveraging specific technical aspects of Global Navigation Satellite Systems (GNSS) such as GPS and Galileo, SkyWire™ technology delivers advanced clock comparisons across widely distributed geographic locations, including alignment with national time standards. It performs extremely precise time measurements between clocks at separate sites that observe GNSS satellite signals simultaneously. This is achieved using our advanced and patented satellite ranging mathematical algorithms, which effectively cancel out common measurement errors to enable extremely precise time comparison across the vast distances between the observed clocks. The core SkyWire technology has been validated by leading physicists and metrology laboratories, ensuring robust traceability to national time standards if desired.

Key advantages of the patented SkyWire technology are its ease of deployment and its ability to scale to simultaneously compare many separate clocks. It is embedded in our TimePictra® synchronization management system, which organizations can use to monitor, configure and control timing networks in real time and visualize clock offsets. This approach allows any clock within a network that uses SkyWire technology to be directly compared to any other clock for comprehensive, real-time analysis of time alignment. This technology is particularly valuable for critical infrastructure and applications like hyperscale data centers that require stringent time traceability by providing verifiable proof of synchronization against national or international time standards as well as between the various clock locations.

Historically, comparing local clocks precisely to a common reference such as UTC has been a complex process performed by specialized metrology laboratories. SkyWire technology simplifies and democratizes this capability, making high-precision time comparison accessible and cost effective for a wide range of users. By enabling direct, real-time comparison of clocks across thousands of miles, SkyWire technology ensures that organizations can achieve and demonstrate the highest levels of timing accuracy, precision and reliability.



Figure 1. SkyWire™ technology leverage signals from GNSS satellites that are simultaneously visible (in common view) to at least two ground locations.

Using Current PNT Infrastructure to Facilitate Accurate Clock Comparison

GNSS has become so widely used in timing applications that critical infrastructure has become overly dependent on it as a source of time. SkyWire technology makes use of GNSS signals, not as a timing source but as a virtual wire that enables precise time comparison. Using existing PNT infrastructure, SkyWire technology enables precise time comparison between geographically separated locations provided they can simultaneously track the same satellites. When two sites have a common view of the same satellites (see Figure 1), they can use the continuously broadcast data and carrier signals as a shared reference point for comparing their local clocks.

Both locations simultaneously receive signals from the same GNSS satellite (see Figure 2) and record pseudo range and carrier measurement data relative to their local clocks. By combining and analyzing these measurements, SkyWire technology compares the time very effectively and precisely on clocks that are separated over long distances.

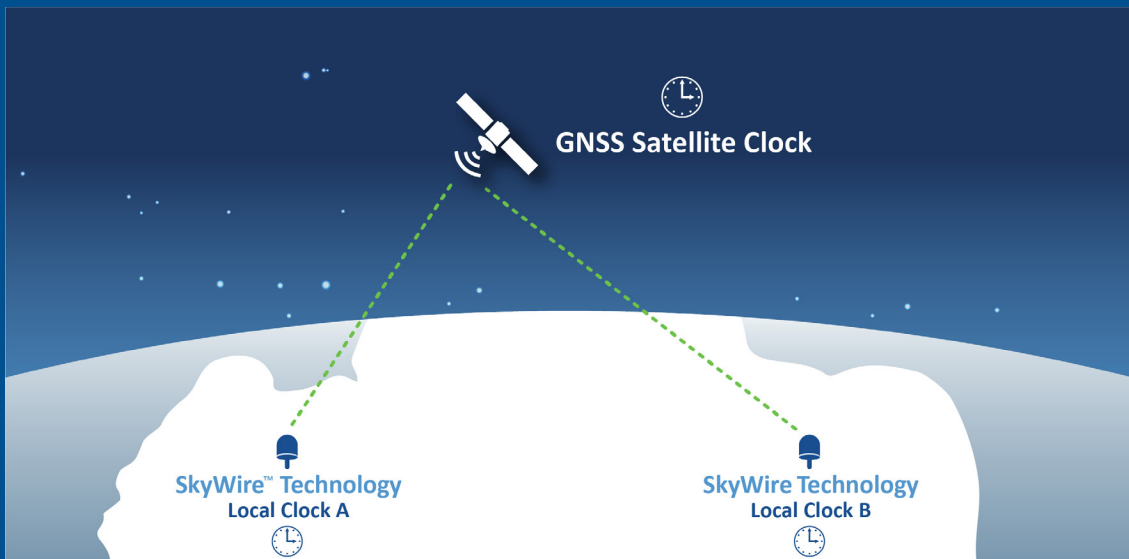


Figure 2. SkyWire technology operates by having at least two or more separated clocks simultaneously receive signals from the same GNSS satellite(s); by comparing measurement data of the signals and removing shared satellite errors, SkyWire technology can precisely determine the time difference between the two or more clocks down to the nanosecond.

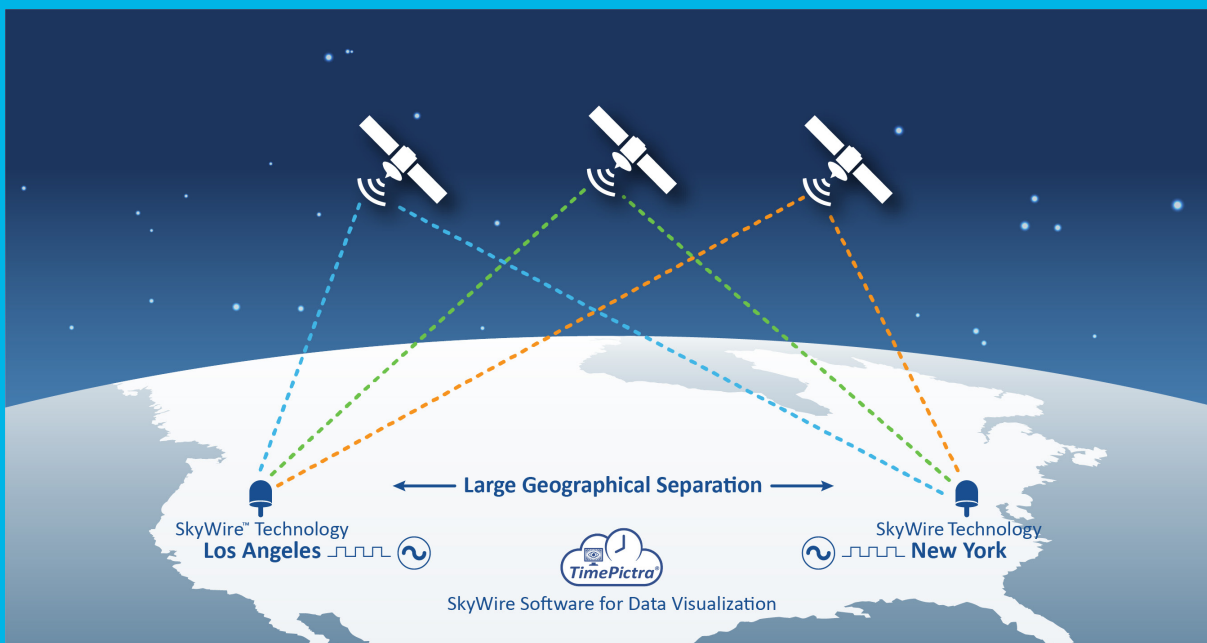


Figure 3. By utilizing GNSS satellites visible to both locations, SkyWire technology can determine the time difference between clocks up to 3,500 miles apart with nanosecond precision, without requiring the local clocks be synchronized to GNSS.

SkyWire Technology Is Only Limited by the Curvature of the Earth and the Satellites in View

SkyWire technology will use all satellites that can be measured simultaneously from wherever it is deployed. In the example deployment illustrated in Figure 3, three satellites are available that can be measured simultaneously from each clock location. As the clocks that SkyWire technology is measuring are positioned farther apart on the Earth's surface, fewer GNSS satellites will be visible to both locations simultaneously for measurement purposes. As the base line between the clocks approaches 3,500 miles, the number of satellites seen by both clocks at the same time approaches one. SkyWire technology will continue to operate effectively as long as there is at least one satellite that is commonly visible and measured by all clocks within the network.

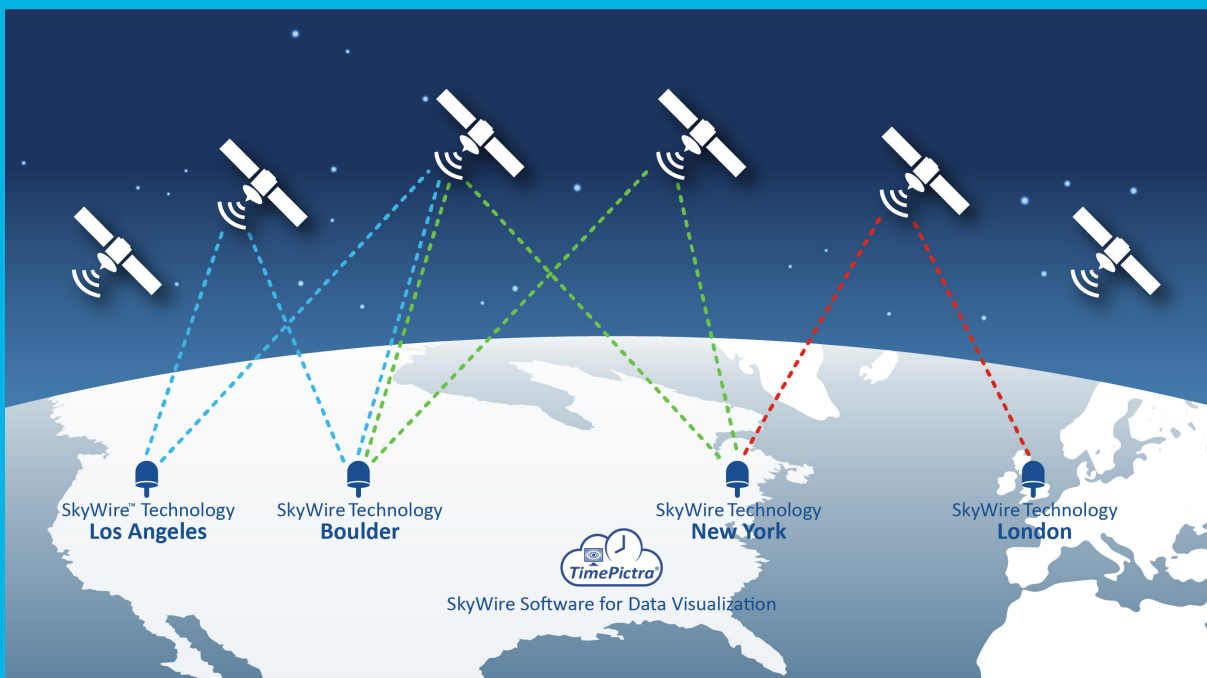


Figure 4 shows a simple deployment model using SkyWire technology to compare clocks at vast distances from each other. Pairs of locations can simultaneously measure multiple satellites that are seen at the same time. The resulting measurement data is aggregated and analyzed by the TimePictra software suite, and the time differences between any and all clocks can be computed and displayed visually. This includes clocks that never measured the same satellites directly; for example, the Los Angeles clock can be compared to the London clock. The TimePictra software suite's capabilities extend beyond simple clock offset plotting; it offers a range of features for managing and monitoring time across the network.

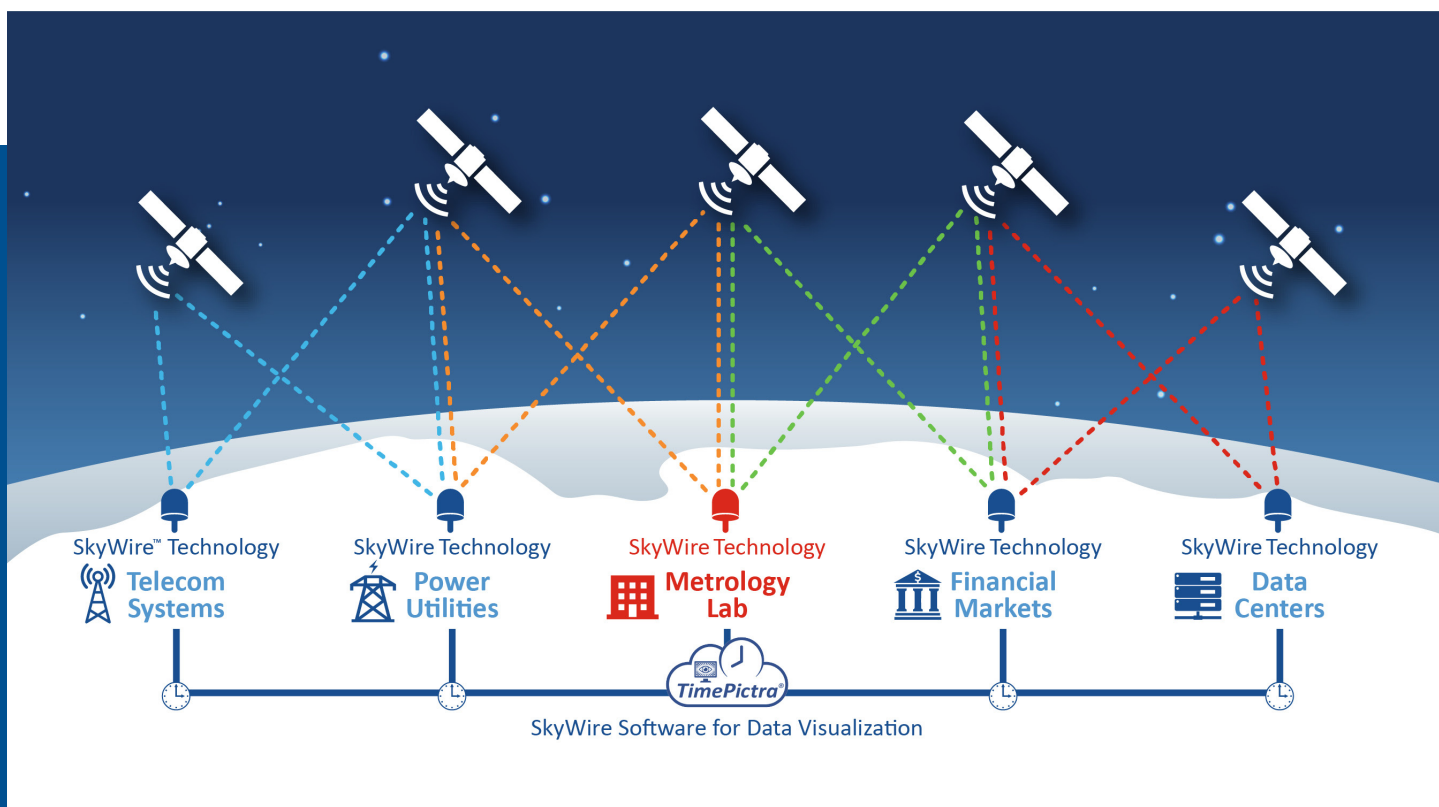


Figure 5. Widely dispersed critical infrastructure—including telecommunications, power utilities, financial markets, and data centers—can leverage SkyWire technology to continuously monitor nanosecond-level time differences between all essential and geographically dispersed system clocks.

National Timing Metrology Labs Around the Globe Utilize the Underlying SkyWire Technology

SkyWire technology incorporates Microchip’s patented algorithms to further enhance its clock comparison technology, empowering organizations—from metrology laboratories to hyperscale data center operators—to compare the time on clocks separated by thousands of miles accurately and precisely, as if they were positioned side by side. SkyWire technology provides a robust method for ensuring and demonstrating that time is traceable to a known standard, offering verifiable proof of the reference against which each clock is compared.

One key deployment model for SkyWire technology is its use in comparing local time with a national time authority. With SkyWire technology deployed at international metrology labs, customers can directly compare their time to their respective metrology labs, ensuring alignment with a national time standard.

SkyWire Technology Can Deliver Traceable Time Aligned With National Time Standards

For critical infrastructure that requires time traceability to a country’s national time standard or just to other clocks that need to be closely synchronized and monitored, SkyWire technology enables high-accuracy measurement and verification to within nanoseconds.

UTC is the most accurate time reference for timestamping. Comparing timing systems to UTC has traditionally been a complex scientific technique that only metrology labs have been capable of performing. SkyWire technology reduces the cost, streamlines the installation and simplifies the use of distributed clock measurement so it can be deployed in thousands of locations.

SkyWire technology is effectively a wide-area clock measurement instrument capable of highly accurate time comparison against a national time authority’s clock, or just to other clocks in the wide area network. This highly scalable solution can measure the clock offsets between hundreds of widely distributed clocks in real time to monitor high-accuracy timing coherency.

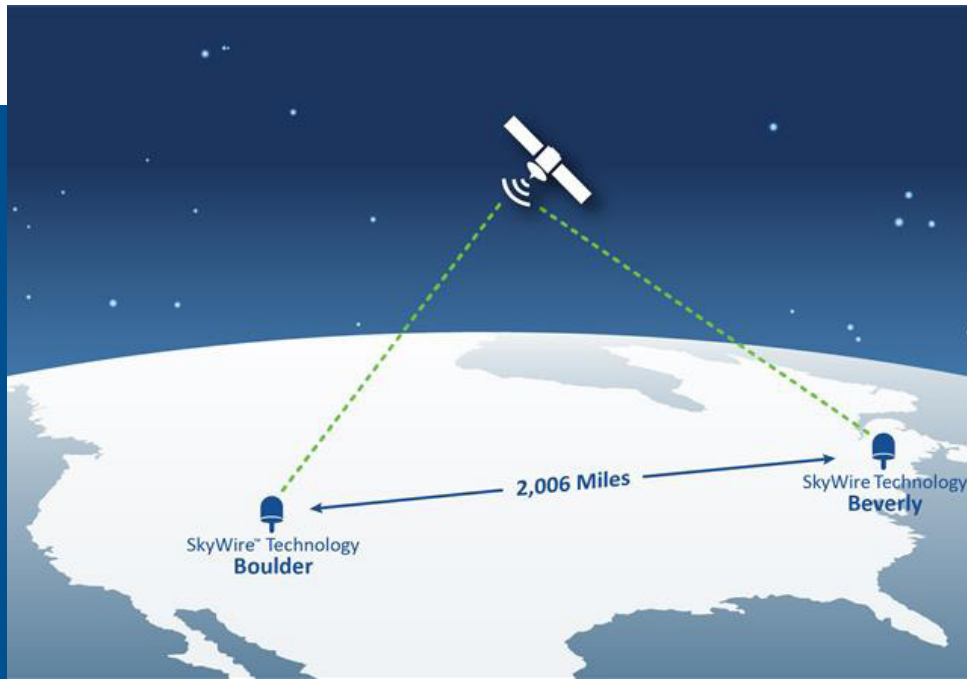


Figure 6. A 2,006-mile baseline between Boulder, CO, and Beverly, MA, was chosen to demonstrate SkyWire technology's ability to compare timing signals accurately and precisely across vast geographic separations.

SkyWire Technology Demonstrates Accuracy and Precision Over 2,000 Miles

The distance and data shown in Figures 6 and 7 demonstrate the effectiveness of SkyWire technology to compare clocks separated by 2,006 miles accurately and precisely. In a simple demonstration of SkyWire technology, a clock in Boulder, Colorado (CO), was compared to a clock in Beverly, Massachusetts (MA). By measuring the GNSS satellite signals that were simultaneously in view at both sites, SkyWire technology made highly accurate and precise timing comparison measurements. This level of widespread accuracy and precision is essential for critical infrastructure and applications that require exact time alignment across distributed sites. While the clock location in Boulder was at a Microchip facility, it just as easily could have been at the NIST Atomic Clock facility located in Boulder and would have provided nanosecond traceability to the official U.S. time between the NIST facility and the clock located in Beverly.

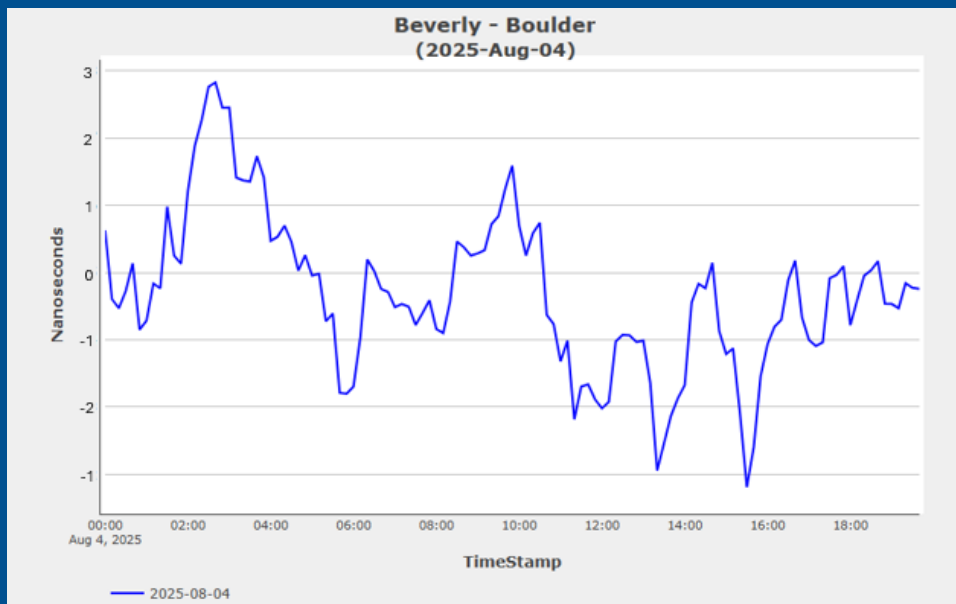


Figure 7. Plot from TimePictra software suite showing how Skywire technology accurately computed a clock comparison time difference between the clock located in Boulder, CO, and the clock in Beverly, MA, highlighting SkyWire technology's ability to measure and present precise clock timing offsets across geographically distant sites.

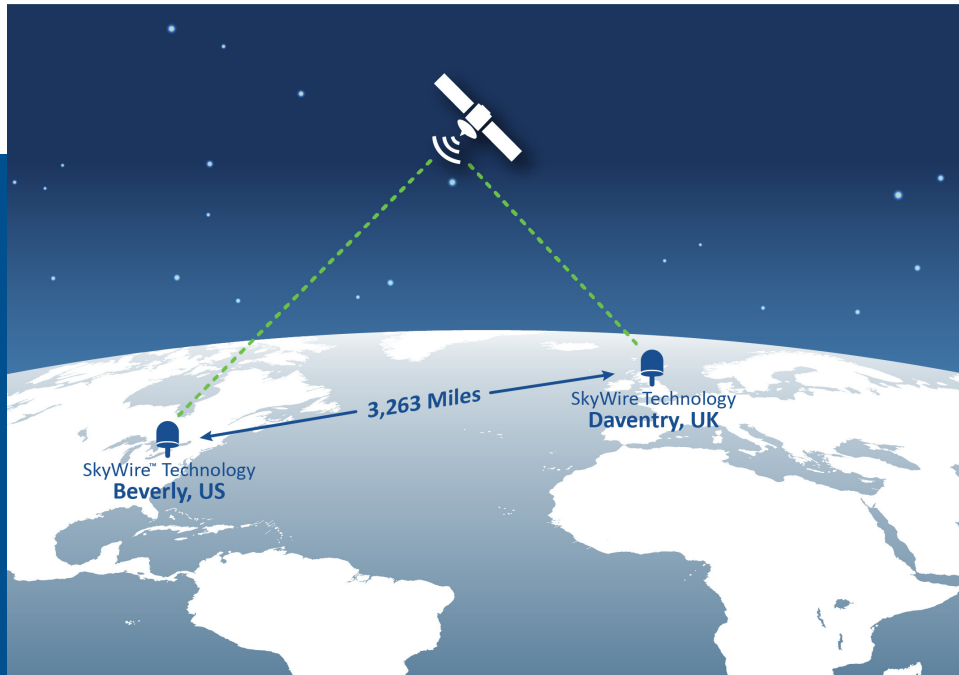


Figure 8. A 3,263-mile baseline between Beverly, MA, and Daventry, UK, was chosen to demonstrate SkyWire technology's ability to compare timing signals accurately and precisely across vast geographic separations.

Skywire Technology Demonstrates Accuracy and Precision Clock Comparisons Across the Atlantic Ocean With 3,200 Miles of Separation Between Clocks

The distance and data shown in Figures 8 and 9 demonstrate how SkyWire technology compared clocks separated by 3,263 miles accurately and precisely. In a simple demonstration of SkyWire technology, a clock in Beverly, MA, was compared to a clock in Daventry, United Kingdom (UK). By measuring the GNSS satellite signals that were simultaneously in view at both sites, SkyWire technology made highly accurate and precise timing comparison measurements. This level of widespread accuracy and precision is essential for critical infrastructure and applications deployed across multiple sites and countries, allowing organizations to compare time across global operations without the need for complex, dedicated physical connections or expensive two-way satellite time transfer connections.

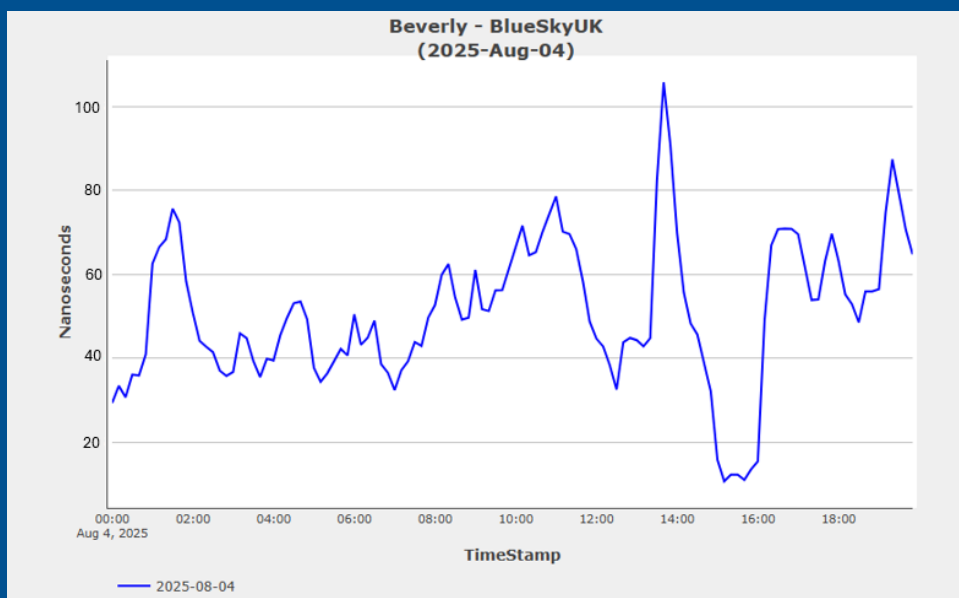


Figure 9. Plot from TimePictra software suite showing how Skywire technology accurately computed a clock comparison time difference between the clock located in Beverly, MA, across the Atlantic Ocean to a clock in Daventry, UK, highlighting SkyWire technology's ability to measure and present precise clock timing offsets across geographically distant sites.



SkyWire Technology Enables Precise Clock Comparison and Traceability Across Wide Geographic Areas

SkyWire technology revolutionizes precise time synchronization by leveraging advanced GNSS features and patented algorithms to enable highly accurate, real-time clock comparisons across widely dispersed locations. Validated by leading experts, SkyWire technology ensures robust traceability to national time standards, offers scalable and easy deployment, and provides organizations—especially those in critical infrastructure—with accessible, cost-effective, and verifiable timing accuracy and reliability.

Services and Support

We provide a wide range of [services and support](#) for our timing systems. We offer the following resources to help you use SkyWire technology in your synchronization network:

- Site survey and verification
- On-site installation
- Consulting services
- Training
- Extended hardware warranty
- Rapid replacement service

To take advantage of these services, please create a [myMicrochip](#) account and subscribe to the [Frequency and Time Resources online support portal](#). You can explore the many resources that are available there and register to receive product and other updates when they are available.



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