



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
National Policy

**ORDER
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1770.68**

Effective Date:
11/03/2020

SUBJ: Selection and Use of Time and Frequency Sources for all Systems, Services, and Applications Supporting NAS Operations

1. Purpose of This Order. This Order establishes the Policy by which Federal Aviation Administration (FAA) time and frequency sources will be selected, modified, upgraded, implemented, and used by systems, services, and applications supporting National Airspace System (NAS) operations in order to ensure safety, security, required performance, and resilience.

2. Audience. This Order applies to all Program Offices and owners of NAS systems, services, and applications that require time and/or frequency to fulfill their mission and support the delivery of services to NAS users.

3. Where to Find This Order. You can find this order on the FAA.GOV website under the “Regulations & Policies” tab by selecting “[Orders & Notices](#)” or on the MyFAA Employee website. Use the “Tools & Resources” tab and select “[Orders & Notices](#).”

4. Approved Time and Frequency Systems.

a. All Program Offices and system/service/application owners shall migrate their systems, services, and/or applications as soon as feasible, but no later than FY 2025, away from using time and frequency systems dependent primarily upon Global Positioning System (GPS), Global Navigation Satellite System (GNSS), and/or Satellite Based Augmentation System (known in the U.S. as Wide Area Augmentation System, or WAAS) and to a National Institute of Standards and Technology (NIST) or United States Naval Observatory (USNO) traceable source provided by resilient FAA enterprise timing systems and/or services.

b. All FAA derivation of, and use of, time and frequency shall promulgate policy and guidance that will implement the underlying principles contained within the National Resilience Policy¹.

¹ National Resilience Policy encompasses Presidential Policy Directive 21 (PPD-21) and Executive Order 13905 (EO 13905).

(1) In accordance with 49 USC § 106(f)(2) & Section 348 of Public Law 104-50 the FAA is prohibited from utilizing the Federal Acquisition Regulation. Therefore, the FAA will develop and incorporate the “contractual language for inclusion of the relevant information from the [positioning, navigation, and timing (PNT)] profiles in the requirements for [FAA] contracts for products, systems, and services that integrate or utilize PNT services, with the goal of encouraging the private sector to use additional PNT services and develop new robust and secure PNT services” into the FAA’s Acquisition Management System approximately 90 days following the PNT profiles being made available by Secretary of Commerce.

(2) Furthermore, Presidential Policy Directive 21 (PPD-21) requires U.S. Critical Infrastructure, such as the NAS, to be resilient so as “to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.”

c. As NAS systems are considered part of the US Critical Infrastructure, use of non-US GNSS systems and their augmentations for the purpose of deriving time and/or frequency is prohibited. All current users of standalone time and/or frequency shall ensure that only US GNSS systems (GPS or WAAS) are used until connection to the networked time and frequency capability can be established.

d. The FAA will establish an Enterprise Time and Frequency Service (ETFS) that will provide networked time and frequency (e.g., Network Time Protocol and Precision Time Protocol) for NAS systems, services, and applications that conforms to all National Resilience Policy.

(1) NAS systems that are connected to the FAA network shall utilize the network-based ETFS to “discipline” an independent, autonomous “primary holdover and integrity” capability (i.e., oscillator) with sufficient holdover capability and associated, periodic updates to maintain the required timing performance (i.e., accuracy, availability, integrity, and continuity) independent of the networked-based ETFS distribution system to ensure safety and continuity of operations.²

(2) A list of NAS systems that have not transitioned to the networked source will be maintained and tracked until connection to the ETFS can be completed.

e. Enterprise time and frequency requirements will be established in the Target NAS Requirements Document (TNRD) to support this Policy.

f. This Order further directs that an Office of Primary Responsibility (OPR) be established to implement NAS system time and frequency Policy, and to determine the means by which systems derive time and/or frequency in compliance with this Policy. The OPR will ensure that all time and frequency sources meet all TNRD requirements and will ensure resilience in accordance with National Resiliency Policy.

² Examples of “primary holdover and integrity” capabilities include cesium, rubidium and chip-scale atomic clocks, as well as oven-compensated quartz crystal oscillator (OCXO) and temperature-compensated crystal oscillators (TCXO) that include the capability to compare multiple sensor inputs.

g. NAS systems or services that require performance exceeding that provided by the ETFS networked source (i.e., increased precision, accuracy, availability, integrity, and/or continuity of service) may propose an alternative time or frequency solution to the OPR for approval.

(1) NAS systems, services, and applications that are not connected to the FAA network shall demonstrate that their standalone time and frequency source meets or exceeds required performance and resilience to preclude impact from intentional or unintentional disruption or manipulation of GNSS signals.

(2) A list of approved standalone time and frequency sources will be maintained by the OPR.

(3) For those NAS systems not utilizing an approved networked or standalone source, the non-approved systems and the applications they support will be tracked by the OPR until all non-approved standalone sources are eliminated from FAA use.

h. Acquisition program checklists, product templates, and other applicable documents will be updated to include time and frequency considerations.

i. NextGen Systems Engineering and Integration, NAS Enterprise Analysis Branch (ANG-B21) will maintain the NAS system time and frequency Policy for all systems, services, and applications that support NAS operations.

5. Rationale for Time and Frequency Policy.

a. The NAS has become increasingly dependent on GNSS for Positioning, Navigation, and Timing (PNT) services. Many systems require time and frequency to support their operations. Time and frequency enable systems to determine time-of-day, measure time difference, and/or to maintain frequency stability.

b. The National Airspace System Enterprise Architecture *NAS Timing Study* revealed that NAS systems obtain time and frequency from a variety of sources, including the existing FAA Telecommunications Infrastructure (FTI) network time services (current leased telecommunications source), co-located systems (e.g., Coded Time Source [CTS] or Digital Audio Legal Recorder [DALR]), or from standalone GNSS timing receivers acquired for the sole use of individual systems. All of these sources are dependent on GNSS for time and/or frequency, either as the sole source or as the only means to discipline their clocks/oscillators.³

c. GNSS satellite signals are extremely low power and are susceptible to interference caused by a variety of events, including jamming, spoofing, space weather, spectrum encroachment, and infrastructure disruptions. If the NAS experiences these disruptions or

³ These clocks whether they be atomic (e.g., cesium or rubidium) or based on older technology (e.g., temperature-controlled crystal oscillators) are highly stable oscillators that can provide precise frequency and precisely “count” time duration. For time-of-day information, these oscillators provide current time based on the duration since their last time-of-day information input. Thus, these clocks need to be disciplined to mitigate errors caused by their frequency variations, and either need to be “re-set” or have adequate holdover capability if they lose time-of-day information.

manipulations, then operations using GNSS time and frequency can receive degraded, misleading signals or cease to receive time/frequency inputs. FAA may even need to replace malfunctioning equipment to restore services, resulting in potentially significant impacts to NAS capacity and efficiency.

d. National Resiliency Policy requires that U.S. Critical Infrastructure, such as the NAS, be resilient so as “to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.”⁴ EO 13905 mandates “the deliberate, risk-informed use of PNT services, including their acquisition, integration, and deployment, such that disruption or manipulation of PNT services minimally affects national security, the economy, public health, and the critical functions of the Federal Government.” Therefore, it is imperative that the FAA implement mechanisms for NAS systems to derive time and frequency from multiple resilient sources or to employ resilient means. Furthermore, to comply with these policies, ensure safety and security, and mitigate the potential impacts associated with known GNSS vulnerabilities, NAS systems shall discontinue using standalone GNSS receivers as the sole or primary means for obtaining time and/or frequency as soon as possible.

e. This Order establishes the FAA Policy for NAS time and frequency users. ANG-B21 is responsible for establishment of this Order including guidance for incorporation into applicable program checklists and product templates. An OPR will be established to implement the guidance within this Order. Until an OPR is established, ANG-B21 will also ensure that all aspects of the policy are followed.

6. Establishing Enterprise Time and Frequency Service (ETFS) and Requirements.

Given the criticality of precise, trustable, and resilient time and frequency to support NAS operations, and to maintain an authoritative time-of-day-tagged legal record of NAS operational data, establishment of a NAS-wide ETFS capability to provide and synchronize (discipline) the distributed use of time and frequency across the NAS is required. ETFS will preclude the need for any system to use GPS, GNSS, or WAAS as their time and frequency source; will ensure that their sources of time meet explicit accuracy, availability, integrity, and continuity performance requirements; and will further ensure that their systems comply with National Resilience Policy. For those systems that are unable to utilize the FAA’s networked ETFS, or where the networked ETFS cannot meet their requirements, an approved, standalone time/frequency source may be approved by the OPR. Time and frequency will be managed by the OPR to ensure that all NAS systems obtain the precise and resilient time and frequency services that they need.

a. Enterprise Time and Frequency Requirements. ANG-B21 conducted an analysis of NAS system time and frequency users, their time and frequency sources, and their needs and requirements. This information, along with analysis of current and future NAS needs, resulted in a recommended set of time and frequency requirements for the TNRD. These requirements will be allocated to both the time and frequency sources and individual NAS systems to ensure resiliency of NAS operations.

⁴ PPD-21

b. Time and Frequency Provisions. For NAS systems that are connected to the FAA operational network, resilient networked time and frequency services (e.g., Network Time Protocol [NTP] and Precision Time Protocol [PTP]) will be provided. For NAS systems that are not connected to the FAA operational network, or when the networked ETFS primary holdover and integrity capabilities do not meet program/system/service requirements, approved standalone time and frequency sources/configurations will be considered for approval. Enterprise time and frequency requirements will be appropriately defined for both the networked and the standalone sources.

c. Compliance To ensure that NAS systems obtain time and/or frequency services that meet their requirements, guidance will be incorporated into Acquisition Management System (AMS) templates and checklists. This guidance will enable programs to incorporate requirements for time and frequency into their system design during key development phases of the AMS lifecycle in compliance with National Resiliency Policy. A program must document their understanding as to how the planned acquisition will comply with the time and/or frequency guidance set forth in this Order and the Federal Acquisition Regulatory Council directed contractual language and requirements required for all Federal PNT contracts and services per EO 13905.

d. Time and Frequency Oversight. ANG-B21 will establish and maintain the Policy for NAS systems that utilize time and/or frequency services. The OPR will be responsible for enforcing the Policy, providing guidance to programs and systems that need a time or frequency source, and ensure the ETFS sources comply with NAS requirements and National Resiliency Policy.

7. Distribution. This order is available electronically as described in paragraph 3.



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Administrator

Appendix A. Definitions

Enterprise Time and Frequency Service (ETFS): The ETFS is a resilient networked source or sources providing precise time and frequency references for all NAS operational users. The ETFS will provide safe, trustable time and frequency traceable to UTC (NIST or USNO).

Frequency stability: The rate of change of a repetitive event defined in Hertz (Hz) per hour; required to maintain synchronization within and across networks.

Network Time Protocol (NTP): A networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. In operation since before 1985, NTP is one of the oldest Internet protocols in current use.

Primary Holdover and Integrity Capability: Provides a primary means for maintenance of time and/or frequency in accordance with application requirements independent of external inputs for a specified duration of time that depends upon application needs. This function provides continuity in the event of EFTS disruptions or delays and enables consistency cross-checks to reject any erroneous inputs that might be received from EFTS or other sensor inputs.

Precision Time Protocol (PTP): A protocol used to synchronize clocks throughout a computer network. On a local area network, it achieves clock accuracy in the sub-microsecond range, making it suitable for measurement and control systems.

Time-of-day: Reference time that is traceable to Coordinated Universal Time (UTC); provided in hours, minutes, and seconds and often includes the date. This is the most common use of time information in NAS systems and is used to timestamp data.

Time difference: Supports determining the time duration of an event or between different events from start to finish. In the future, additional precision may be required.

Appendix B. References

Executive Order on Strengthening National Resilience through Responsible Use of Positioning, Navigation, and Timing Services, February 12 2020, <https://www.whitehouse.gov/presidential-actions/executive-order-strengthening-national-resilience-responsible-use-positioning-navigation-timing-services/>, accessed on July 8 2020.

National Airspace System Enterprise Architecture *NAS Timing Study*, FAA Office of NAS Systems Engineering & Integration, July 9 2019, https://sep.faa.gov/includes/documents/FAA_NAS_TimingStudyReport_07092019-508.pdf, accessed on July 8 2020.

Presidential Policy Directive 21, *Critical Infrastructure Security and Resilience*, February 12 2013, <https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil>, accessed on July 8 2020.

Target NAS Requirements Document (TNRD) 2018, Version 2.9, December 2018, <https://sep.faa.gov/file/get/3221>, accessed on July 8 2020.