



## TDM to IP Transition Briefing

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- Problem Statement
- Recommendations
- NAS Overview
- FTI Service Mix – TDM and IP
- Concerns with IP and Wireless Alternatives
  - Timing and Synchronization
  - Service Performance
  - Information Security
- FAA System Modernization Summary
- Discussion

# Problem Statement

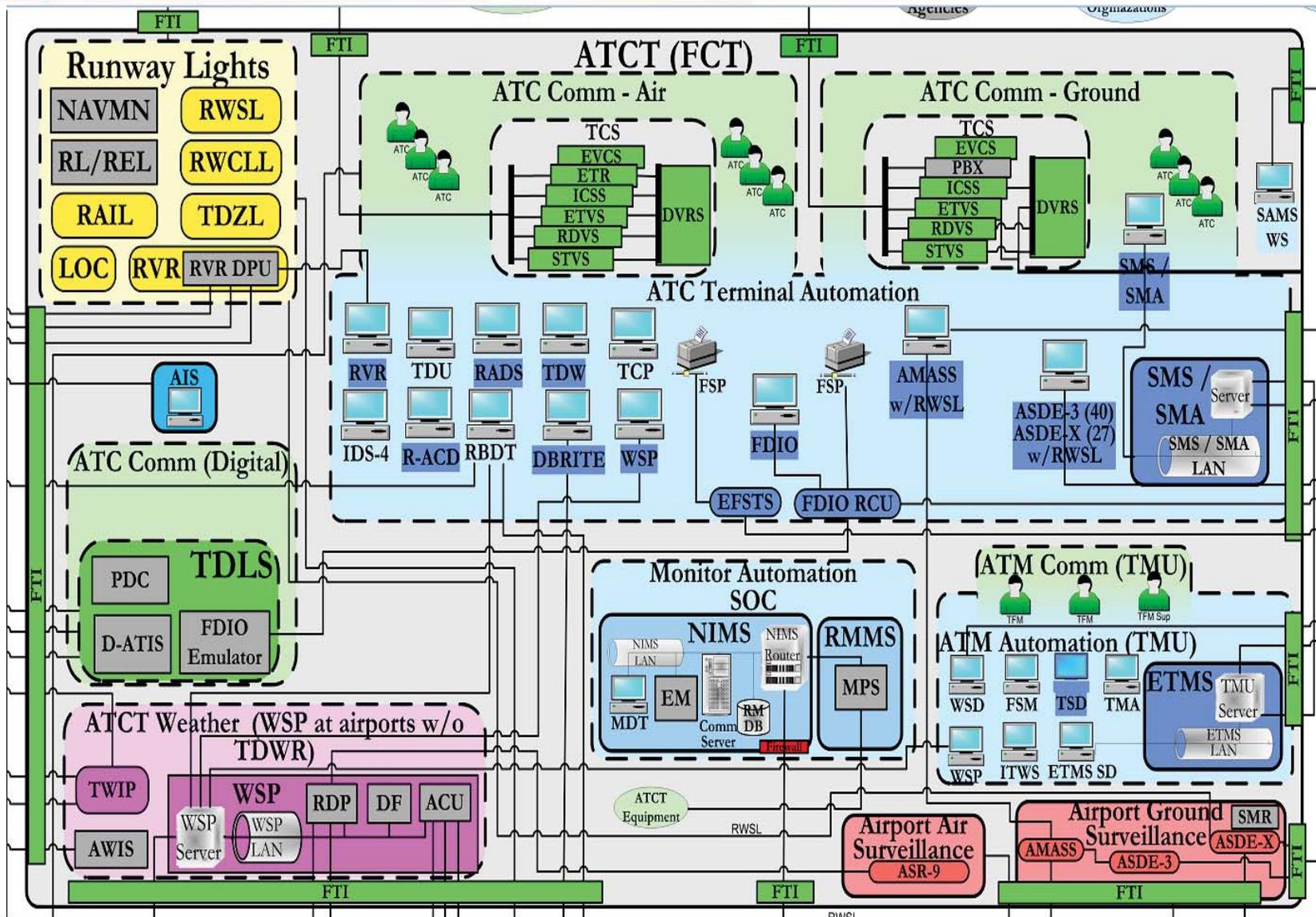


- Current policy proposals suggest discontinuing provision of Time Division Multiplexing (TDM) services at trial level and more comprehensively.
  - Some providers indicate objective to discontinue TDM services by 2020.
- The FAA's Telecommunications Infrastructure (FTI) Program, which provides the telecommunications services the FAA needs for the National Airspace System, uses TDM applications and services extensively to deliver those services.
- While efforts are being made through the FAA's "NextGen" Programs to upgrade the National Airspace System (NAS) to communications interfaces based upon Internet Protocol (IP) standards, the vast majority of FTI services continue to be TDM-based.
- Support for TDM technologies will be required beyond 2020 until methods of replacing TDM-centric services and delivery of IP-based and digital services can be achieved.

- The Order on IP transition trials to be issued in January 2014 should have a mandatory condition for any trial that protects FTI operations dependent on TDM services
  - Prior to any IP Transition Trial, the Commission should require participating carriers to, in partnership with the FAA, identify services that could be impacted at implicated Serving Wire Centers (SWCs) and provide suitable technical solutions.
- The Commission should consider working with the FAA/Harris on IP Transition evaluations at FAA testing locations in Atlantic City and/or Oklahoma City.
  - Funding for trials and testing must be addressed. There is currently no funding source identified to support this activity.
- Any carrier proposal for an IP trial must be vetted with stakeholders, so any FTI-impacting trial component can be identified prior to any trial going forward. This creates an additional safety net.



# Air Traffic Control Tower (ATCT) Detail





- The NAS is a large and diverse enterprise with over 22,000 services

Service Implementation	Service Count	Percent of Total
TDM Services	21051	92%
IP Services	1928	8%
Total Services	22979	

*The Vast Majority of FTI Services Are TDM-Based*

# Technical Issues with IP and Wireless Alternatives for TDM

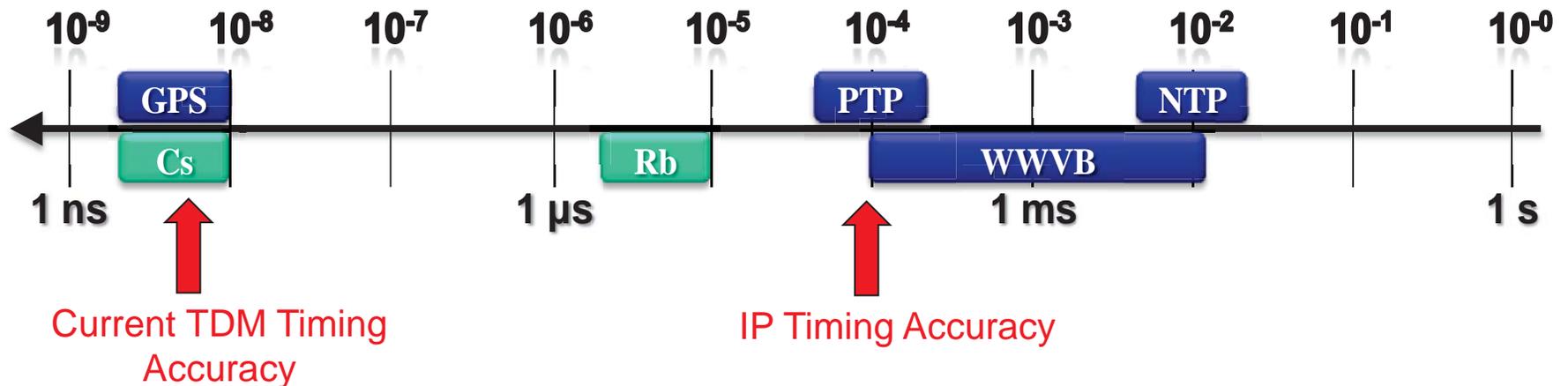


- Timing and Synchronization
- Service Performance
- Information Security

# Timing and Synchronization



- FAA Legacy TDM-based systems require timing accuracy traceable to a GPS or Cesium clock source
- FAA NAS Navigation and Weather Systems also require accurate timing
- IP timing techniques such as Network Time Protocol (NTP) or Precision Time Protocol (PTP) do not provide the needed accuracy



*Carrier-Provided TDM T1 Circuits Provide the Necessary Timing Accuracy for Key NAS Systems*

# Service Performance



- The primary mission of the NAS is to ensure the safety of the flying public
- FTI availability and latency requirements are stringent:

### AVAILABILITY

RMA1	0.9999971
RMA2	0.9999719
RMA3	0.9998478
RMA4	0.9979450
RMA5	0.9972603
RMA6	0.9904215
RMA7	0.9970000

### LATENCY

LL1	50ms
LL2	90ms
LL3	225ms
LL4	350ms
LL5	750ms
LL6	1000ms
LL8	370ms

- The availability of Carrier Ethernet services varies due to differences in implementation and standards maturity
- Carriers do not currently offer Service Level Agreements (SLAs) for their 4G LTE wireless networks
  - Dependent on cell density, capacity over a shared infrastructure, and other factors
  - Early evaluations have also observed significant latency issues

*Wireless and Ethernet Do Not Provide the Required Availability and Latency Performance Needed for Critical NAS Services*

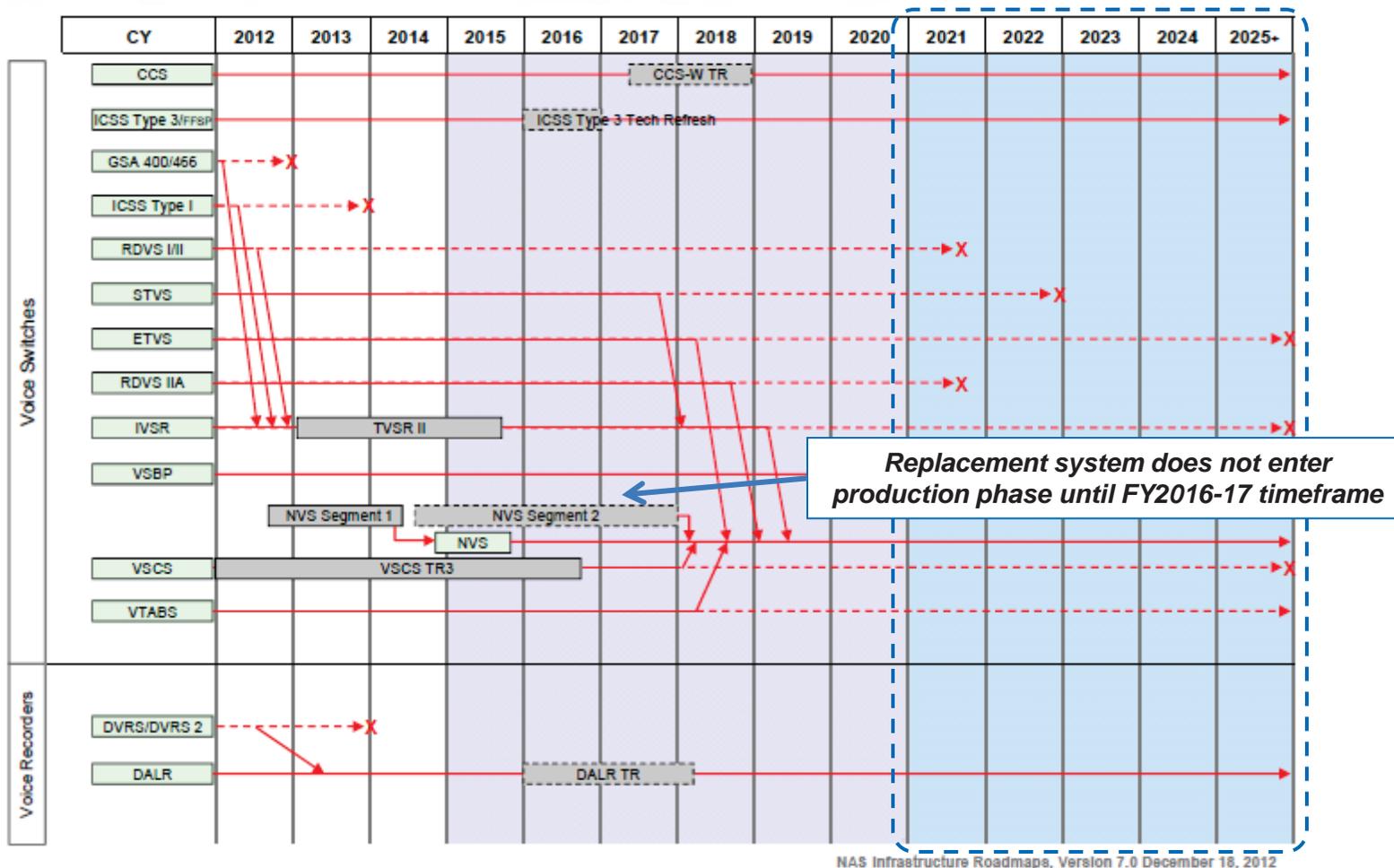
- FTI provides Private Line TDM services that do not share bandwidth with other services
- Private Line TDM services provide deterministic performance
- Statistically multiplexed IP services and Carrier Ethernet services share bandwidth and exhibit stochastic behavior
  - FTI provides private IP service by implementing IP technology over TDM technology
  - Routers are not shared with any other users outside of the NAS
  - Private IP implementation greatly reduces the threat of outsider attacks
- Wireless services are susceptible to jamming
  - Creates risk if both primary and backup circuits are wireless

*Shared Infrastructure IP, Carrier Ethernet, and Wireless Services Are Less Secure Than Private Line TDM Terrestrial Services*

- The FAA has five NextGen transformational programs underway that will utilize updated communications interfaces as part of modernizing the NAS:
  - Automatic Dependent Surveillance Broadcast (**ADS-B**)
  - Data Communications Integrated Services (**DCIS**)
  - NAS Voice System (**NVS**)
  - System Wide Information Management (**SWIM**)
  - NNEW (now called **CSS-Wx** - Common Support Services Weather )
- NVS will upgrade many of the VG-x interfaces to VoIP technology but it is expected to take more than ten years to complete transition
  - Progress dependent on consistent funding and mitigation of operational risk
- Other programs such as Surveillance Interface Modernization (SIM) will upgrade many DDC interfaces but it is expected to take several years to complete transition
- However, there are many TDM legacy interfaces that these NextGen programs do not upgrade
  - e.g., Weather Sensors, Flight Strips, Flight Movement, etc.

*NextGen Does Not Currently Plan to Upgrade All Legacy TDM Interfaces and It Will Take Several Years to Upgrade Those That it Does*

# Example 1: FAA Roadmap for Voice Switches and Recorders



*Legacy TDM-Based Switches Will Remain in Operation Beyond CY2020*

# Discussion