



VDL Mode 3 Integrated Voice and Data Link

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VDL Mode 3 Overview



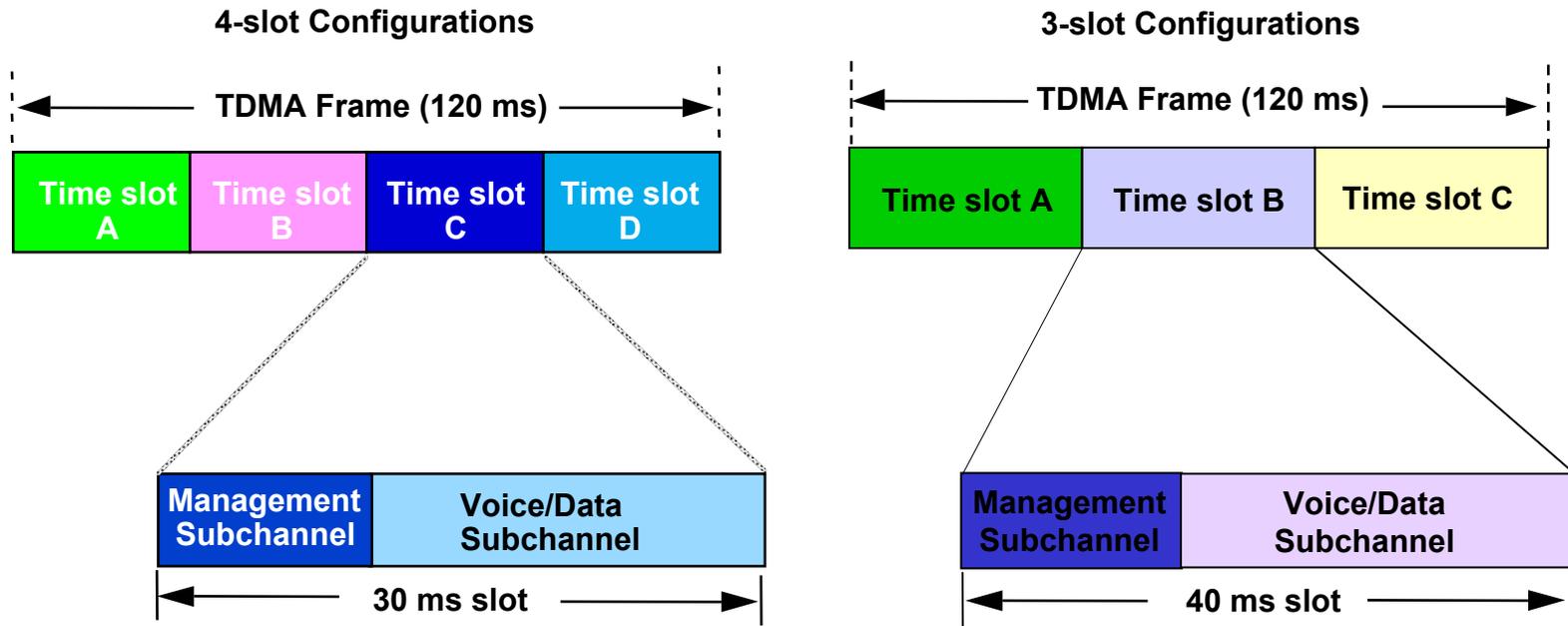
- **VHF Digital Link (VDL) Mode 3 is an international standard for future Air Traffic Control (ATC) communications**
 - **Development began in early 1990s**
 - **Recommended by RTCA SC-172 as future ATC integrated voice/data link in 1994**
 - **Selected by FAA as basis of Next Generation Air-Ground Communications (NEXCOM) in 1998**
 - **ICAO SARPs (international standard) released 2001**
 - **FAA awarded NEXCOM ground radio contract in July 2001**
 - **FAA negotiated 3 avionics development agreements in December 2001**
 - **FAA awarded competitive ground system development contracts in February 2003**

VDL Mode 3 Characteristics



- **Time Division Multiple Access (TDMA) waveform supports non-interfering voice and data link**
 - **Up to four channels in one current VHF 25 kHz frequency assignment: expands resources for ATC voice**
 - **Flexible channel assignments made by ground control and communicated automatically to airborne digital radios**
 - **Separate Management channel (M-burst) controls channel access, keeps system timing, maintains user group status**
- **For further information on Mode 3 fundamentals, visit the FAA NEXCOM web site:
www.faa.gov/nexcom/vdl_mode3.htm**

VDL Mode 3 Channel Structure



- 120 ms “TDMA frame” is the fundamental timing framework
- Each slot may contain two independent “bursts”
- M bursts are used for channel management; while V/D bursts are used for voice or data transfers

Sample System Configurations



System Configuration	Voice	Data	User Groups Supported	Addresses Per Group	Services Provided
4V	Y	N	4	60	Dedicated Voice
3V1D	Y	Y	3	60	Dedicated V Shared D
2V2D	Y	Y	2	60	Dedicated V and D
3V	Y	N	3	60	Dedicated Voice
2V1D	Y	Y	2	60	Dedicated V Shared D
1V2D	Y	Y	1	240	Dedicated V and D



- **Voice operation: Like AM, only better!**
 - TDMA voice channel “looks like” a frequency
 - “Party-line” voice for dedicated “talk group”
 - Excellent voice quality to edges of coverage
 - New features: “step-on” protection, controller override, urgent voice request, Next Frequency
 - UHF AM voice for military supported as at present
- **Data link: Optimized for ATC**
 - “Simultaneous” Tx/Rx with voice, non-interfering
 - Supports priority, acknowledgement
 - ATN subsystem with Interdomain Routing Protocol, “Make-before-break” features

Required Equipment



- **Ground Infrastructure**
 - FAA-owned and integrated with current nationwide AM air-ground radio system
 - ATC sectors will be either AM or Mode 3
 - Digital infrastructure enhances security, safety
 - Digital telecom offers operational cost savings
- **Avionics**
 - Digital radios required to participate in Mode 3
 - Mode 3 capability planned as upgrade to current multimode radios that support AM, VDL Mode 2
 - Mode 3 options include Basic Voice, Enhanced Voice and Enhanced Voice/Data Link
 - Basic Voice only will be required equipage for operating in Mode 3 sectors

NEXCOM Transition

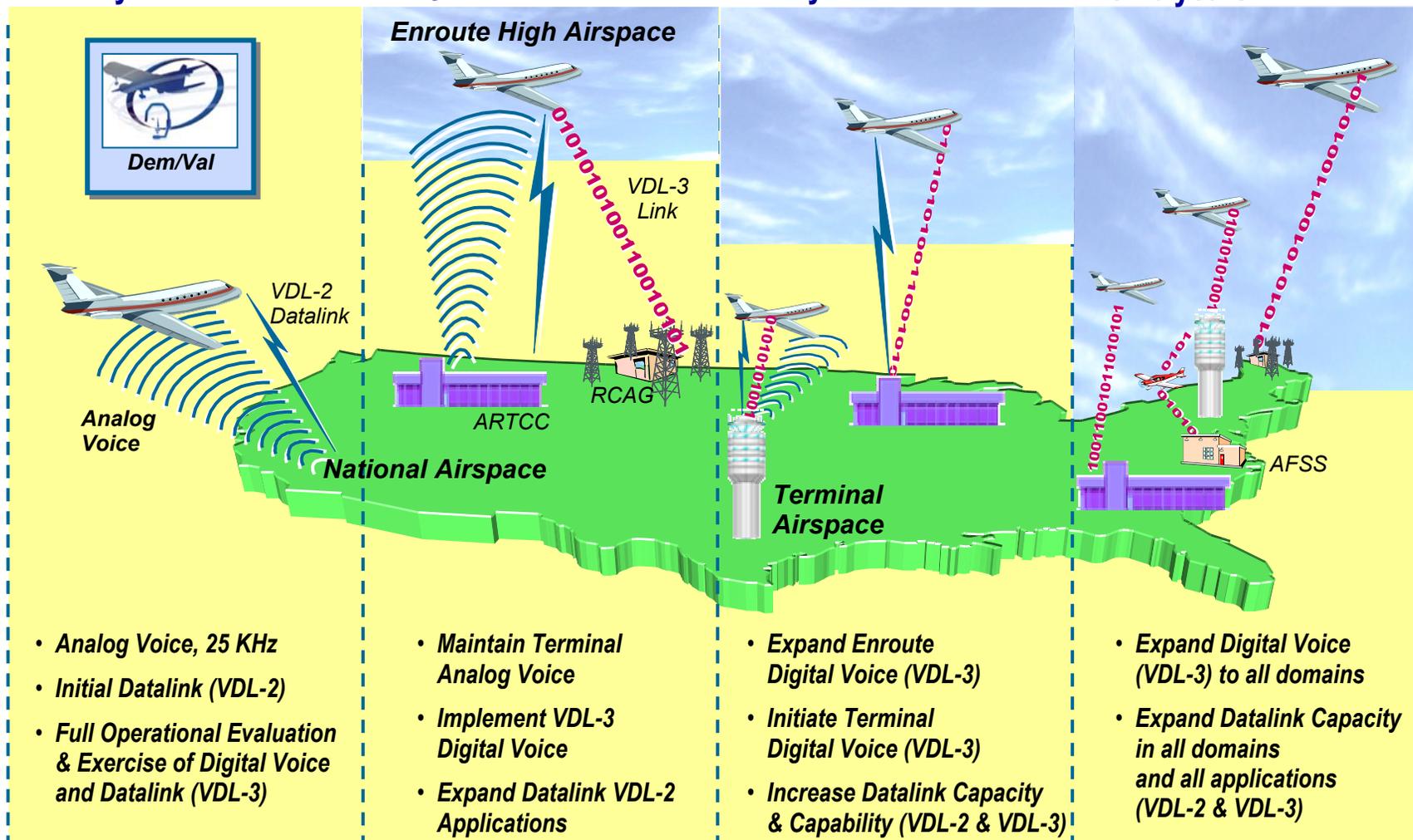


Next 5 years

5-10 years

10-15 years

15-20 years





- **Controller-Pilot Data Link Communications (CPDLC)**
 - Phase 1 and Phase 1A use VDL Mode 2 through private service provider
 - Mode 3 data services to be phased in (~2010)
 - Services may be partitioned by criticality, equipage
- **Flight Information Services (FIS)**
 - Includes digital ATIS, weather maps
 - Provided by private firms through FAA agreements
 - Basic services free, others by subscription

ATS Data Capacity, Cost



- **Rough estimates on required capacity and cost of CPDLC 1A at peak usage across NAS**
 - Based on FAA peak loading requirement for CPDLC 1A
 - Detailed assumptions and calculations in Kabaservice paper in Proceedings
- **Infrastructure impact and significant user cost possible if Mode 2 is used exclusively**
 - 13 new Mode 2 frequencies for CPDLC in crowded spectrum
 - Total service provider charges of >\$1B/yr at today's rates
- **Mode 3 data link avoids these potential problems**
 - Needed capacity already planned in NEXCOM infrastructure
 - Needed data channels created by conversion from AM
 - FAA not planning user fees for Mode 3 services

Conclusions



- **VDL Mode 3 (NEXCOM) offers significant benefits for both voice and data link**
 - **Efficiency of use of VHF ATIS spectrum**
 - **High-quality voice with improved security and safety features**
 - **Integrated non-interfering data link for time- and safety-critical ATC**
 - **Lower operational costs for FAA**
 - **Potential cost avoidance for future data link users**
- **These factors need to be carefully considered by all aviation stakeholders**