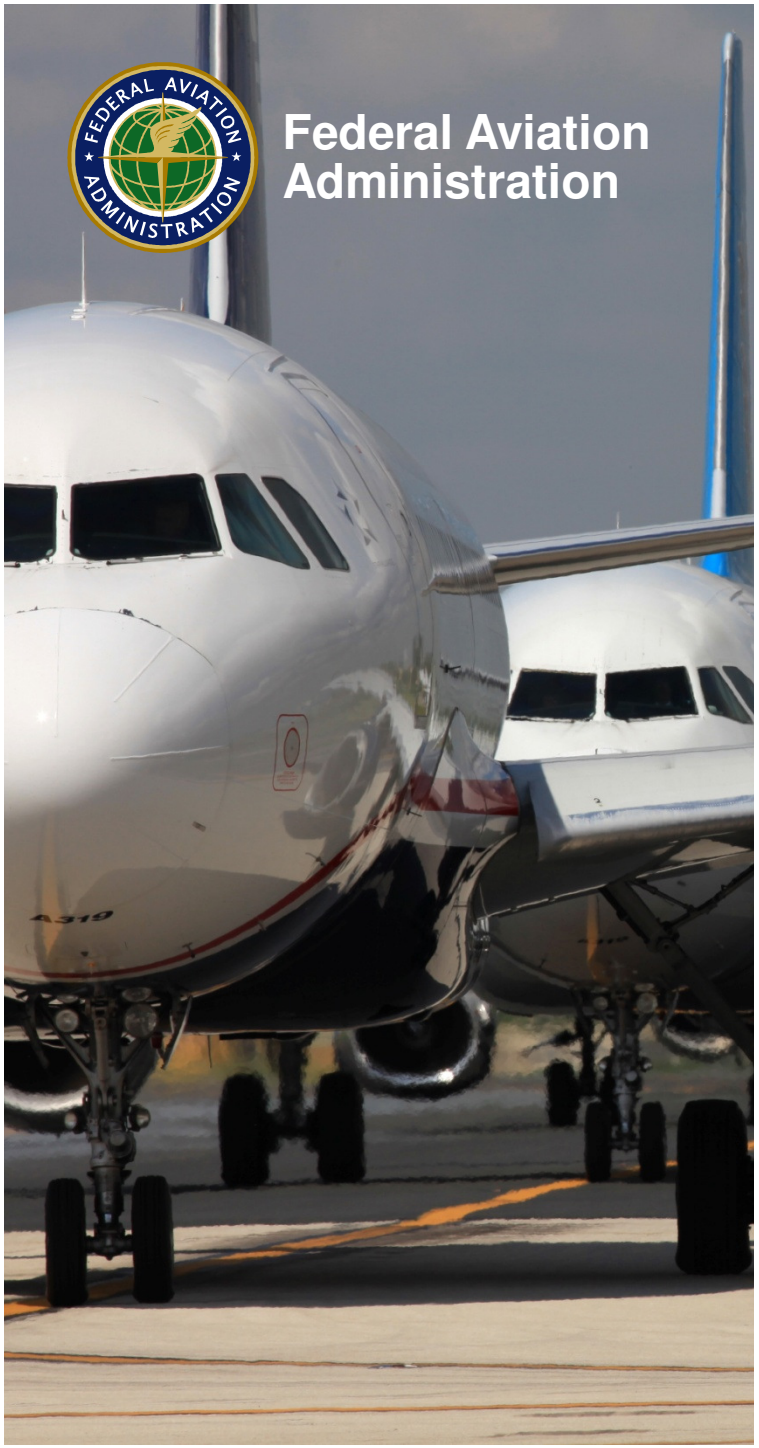
NAM/CAR/SAM
Air Traffic Services (ATS) Data Link Implementation Workshop

Philipsburg, Sint Maarten,
18-21 April 2016

P31: AMHS Implementation and MET XML Testing



Agenda

- AMHS Overview
- AMHS Implementation Process
- AMHS Implementation Observations
- AMHS and XML

Why AMHS?

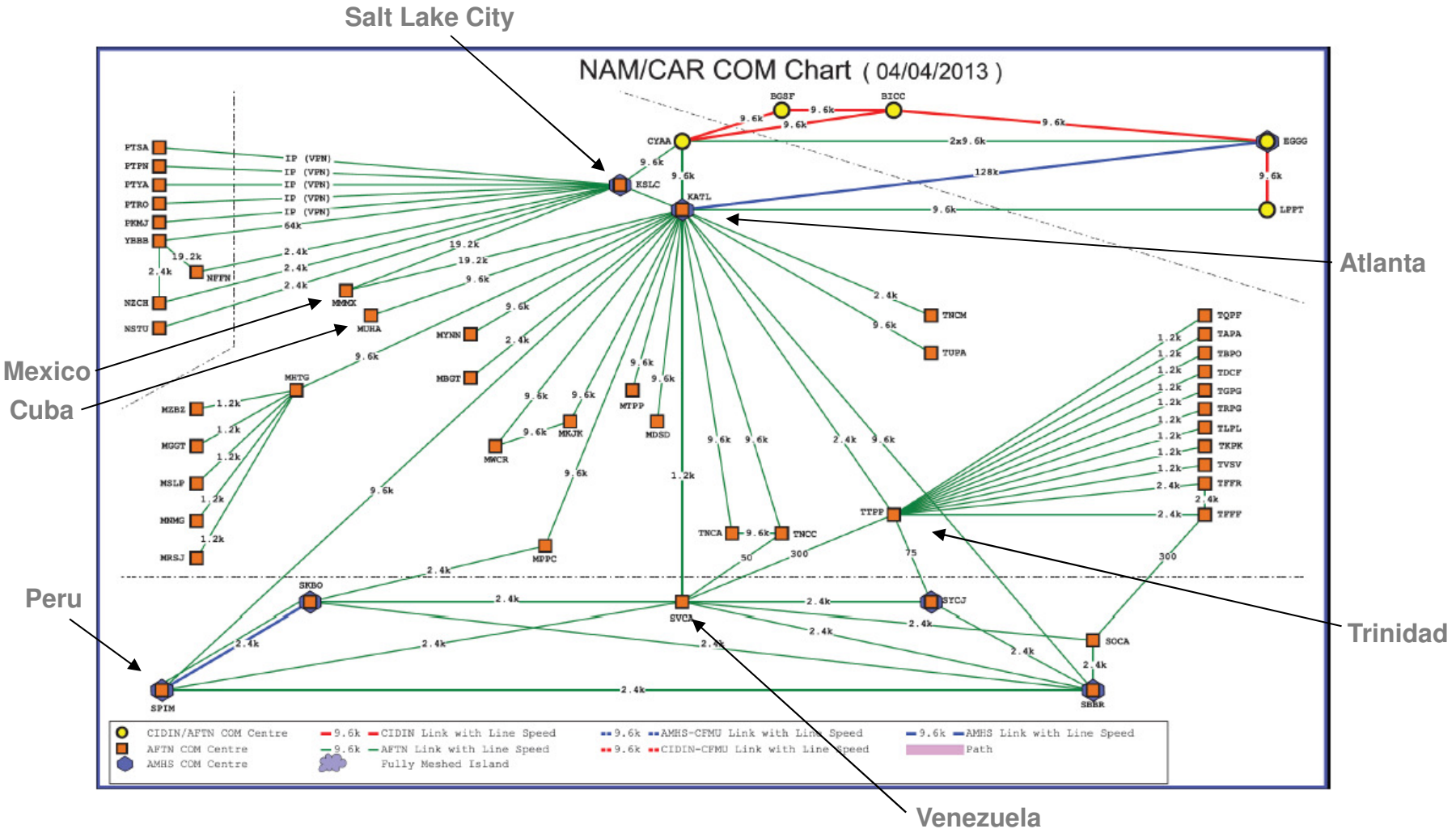
- Aeronautical Fixed Telecommunications Network (AFTN) used for the exchange of Flight Planning, Flight Progress, Aviation Data, Weather and Distress messages between Air Navigation Service Providers (ANSPs)
- Air Traffic Services (ATS) Message Handling System (AMHS) is the replacement message service for the AFTN
- ICAO has mandated transition to AMHS (typically IP)
- AMHS is an X.400-like message exchange; envisioned to support network re-routing rather than application re-routing[1]

1. AMHS routes messages to Message Transfer Agents (MTAs) based on IP address, thus routing around network faults.
AFTN is a store and forward system to nearest neighbors, requiring application intervention if a nearest neighbor link is down.

AFTN

- Text based messaging.
- Original infrastructure low speed landlines between major centers
- Currently implemented with X.25 networking
- AFTN uses Sequence Numbering for message continuity and integrity
- AFTN uses 8 character routing Addresses:
  - 4 char Location Indicator defined in ICAO Doc. 7910 and
  - 4 letter facility code, e.g. Control Tower (ZTZX) AFTN office (YFYX)
- AFTN has a limited number of recipient addresses per message
- AFTN has a maximum message size
- AFTN has a limited character set

Caribbean AFTN Chart

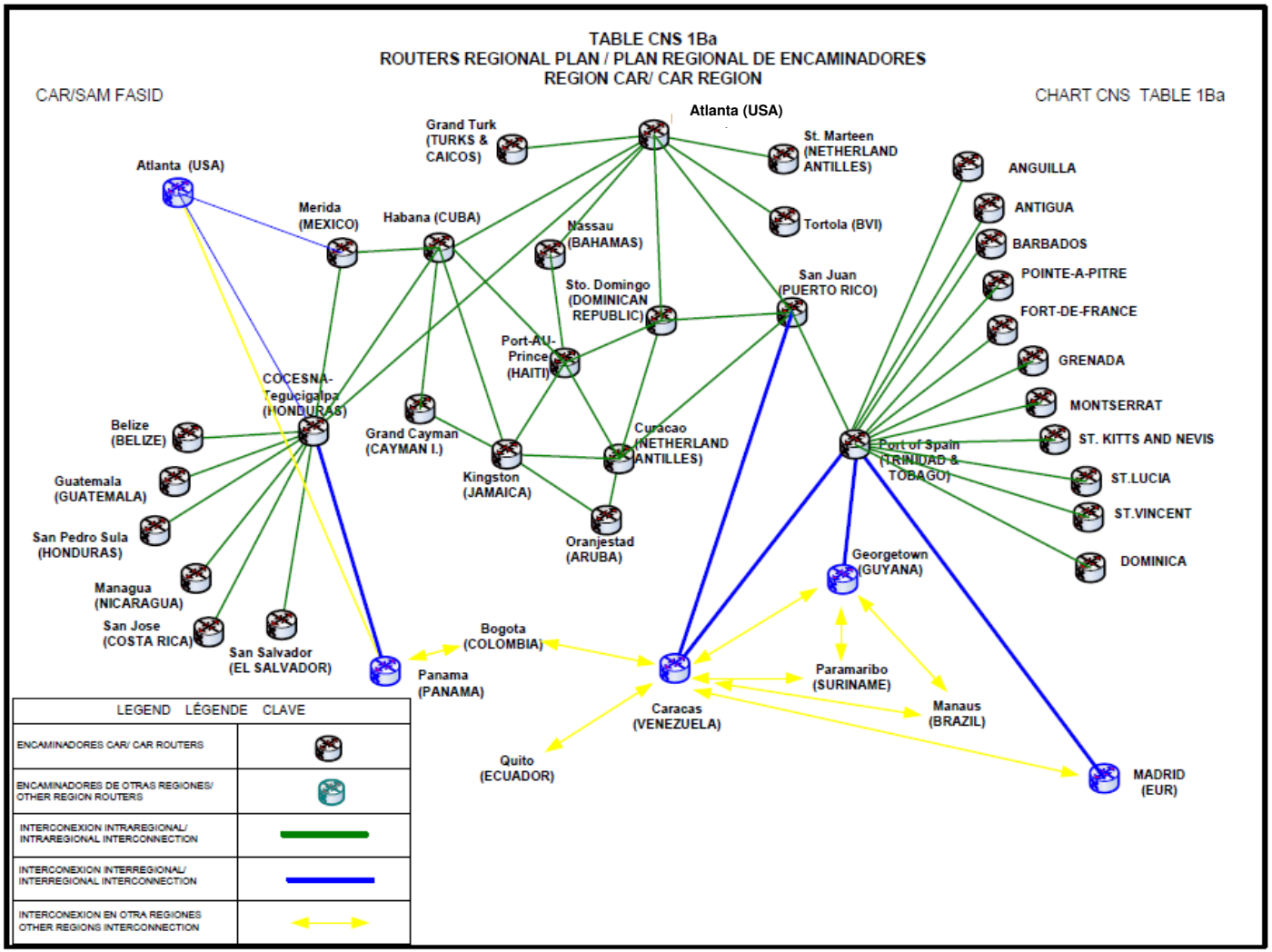


AMHS is here

AMHS

- Messaging typically with IP networking
- Based on X.400
- Standard protocols (transport, session) for continuity & integrity
- Two main classes of service:
  - ATS Basic Service
  - ATS Extended Service
- Allows for unlimited recipients per message
- Message size is larger than AFTN
- Offers extensibility, using standard X.400 attributes and extensions with per recipient and per message extensions
- Allows message redirection, preconfigured alternate routes, and delivery reports

eANP Network Plan (ICAO 8733)



Basic Services vs Extended (added value)

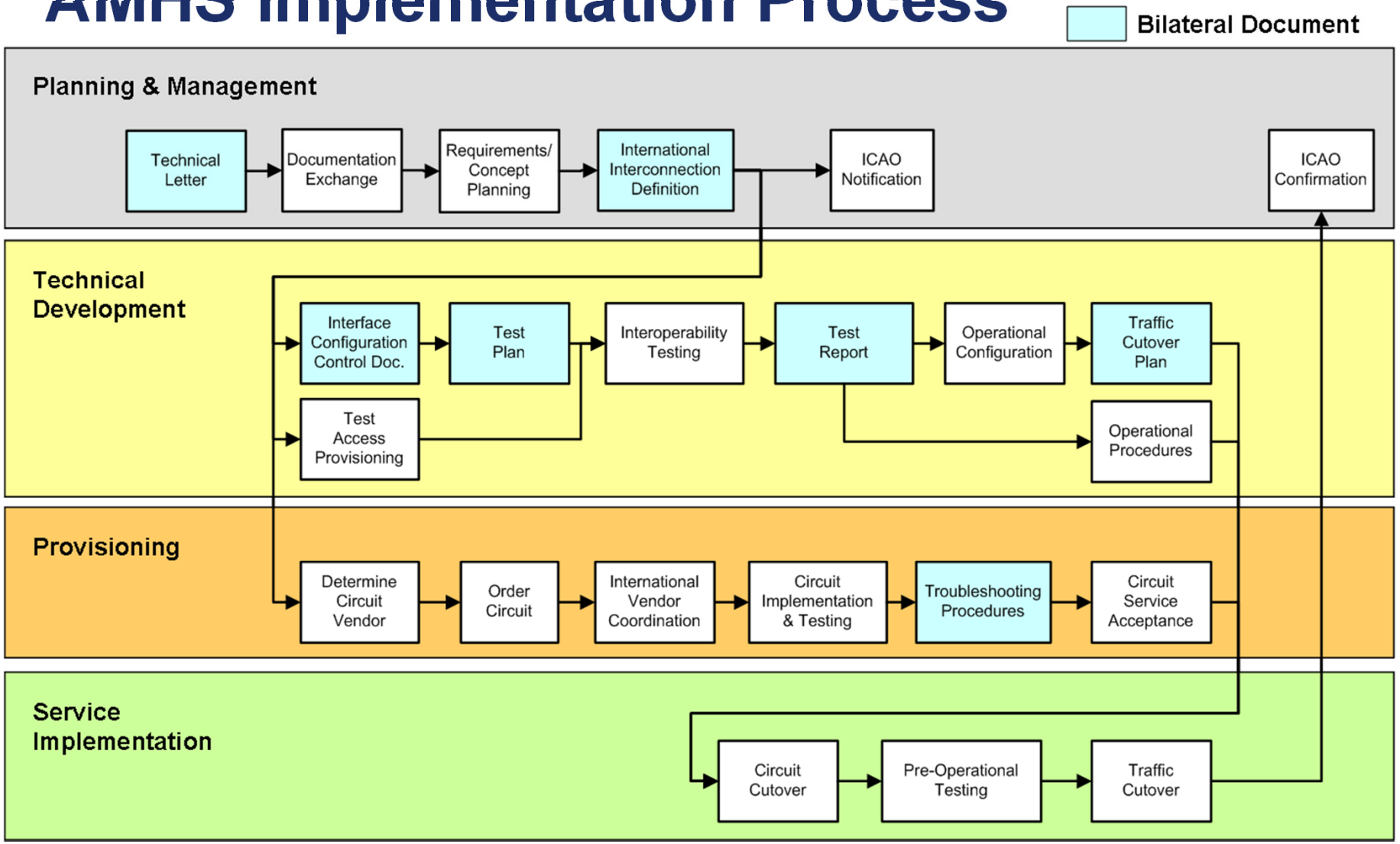
Basic Service:

- Security is obtained by procedural means rather than technical features.
- Limited format (AFTN-like)
- Restricts X.400 capabilities to limited subset (single IA5 body-part)
- Maps AFTN service elements to fields in message text

Extended Service:

- Extends the number and types of body-parts (i.e., message contents), which allows for binary data transfers
- Specifies a mapping of message elements to X.400 extension attributes
- Adds Security elements of service, which includes digital signatures, message repudiation, and security labels
- Adds the use of ATN Directory Service, with uses that include the determination of level of recipient service, repository for distribution lists, address conversion, and repository for user security certificates
- Specifies the use of a Message Store with P7 client connections

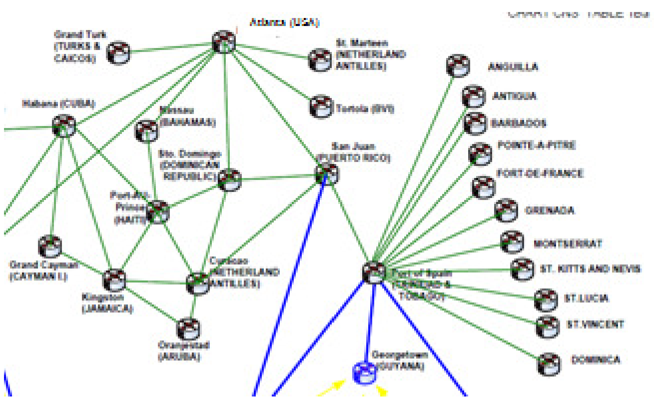
AMHS Implementation Process



Observation – IP Networking

ANSPs must consider IP Networking

- Needs network experience vs messaging experience
- Gateway Router (to MEVA / other ANSPs)
- Serial IP connections (over MEVA) vs RJ45 Ethernet
- Address NAT'ing for the CAR/SAM IPv4 scheme
- Need to be mindful of network Security



PART I

Region	Nro	Estado / Territorio	Red	Rango de direcciones utilizables	Notacion Decimal			
	1	Aruba	10.16.0.0/19	HostMin: 10.16.0.1	10	16	0	1
				HostMax: 10.16.31.254	10	16	31	254
	2	Netherlands Antilles	10.16.32.0/19	HostMin: 10.16.32.1	10	16	32	1
				HostMax: 10.16.63.254	10	16	63	254
	3	Trinidad and Tobago	10.16.64.0/19	HostMin: 10.16.64.1	10	16	64	1
				HostMax: 10.16.95.254	10	16	95	254
	4	Grenada	10.16.96.0/19	HostMin: 10.16.96.1	10	16	96	1
				HostMax: 10.16.127.254	10	16	127	254
	5	Saint Vincent and the Grenadines	10.16.128.0/19	HostMin: 10.16.128.1	10	16	128	1
				HostMax: 10.16.159.254	10	16	159	254
	6	Barbados	10.16.160.0/19	HostMin: 10.16.160.1	10	16	160	1
				HostMax: 10.16.191.254	10	16	191	254
	7	Saint Lucia	10.16.192.0/19	HostMin: 10.16.192.1	10	16	192	1
				HostMax: 10.16.223.254	10	16	223	254
	8	French Antilles	10.16.224.0/19	HostMin: 10.16.224.1	10	16	224	1
				HostMax: 10.16.255.254	10	16	255	254
	9	Dominica	10.17.0.0/19	HostMin: 10.17.0.1	10	17	0	1
				HostMax: 10.17.31.254	10	17	31	254
	10	Montserrat	10.17.32.0/19	HostMin: 10.17.32.1	10	17	32	1
				HostMax: 10.17.63.254	10	17	63	254
	11	Saint Kitts and Nevis	10.17.64.0/19	HostMin: 10.17.64.1	10	17	64	1
				HostMax: 10.17.95.254	10	17	95	254
	12	Antigua and Barbuda	10.17.96.0/19	HostMin: 10.17.96.1	10	17	96	1
				HostMax: 10.17.127.254	10	17	127	254
	13	Anguilla	10.17.128.0/19	HostMin: 10.17.128.1	10	17	128	1
				HostMax: 10.17.159.254	10	17	159	254
	14	Virgin Islands	10.17.160.0/19	HostMin: 10.17.160.1	10	17	160	1
				HostMax: 10.17.191.254	10	17	191	254

Rango de direcciones utilizables	Notacion Binaria																															
	1st BYTE								2nd BYTE								3rd BYTE								4th BYTE							
	8 bits								4 bits				4 bits				3 bits			5 bits					8 bits							
	Network								Subnet											Host												
									Region				Estado / Territorio																			
HostMin: 10.16.0.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.31.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.16.32.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.63.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.16.64.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.95.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.16.96.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.127.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.16.128.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.159.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.16.160.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.191.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.16.192.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.223.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.16.224.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.16.255.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.17.0.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.17.31.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.17.32.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.17.63.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.17.64.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.17.95.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.17.96.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.17.127.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.17.128.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.17.159.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0
HostMin: 10.17.160.1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HostMax: 10.17.191.254	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0

Observation - Testing

Consider vendor application training and support

- Support in establishing test configuration parameters
- Support for operational training

Consider issues of testing with a live AFTN application

- Already using AMHS-capable application for AFTN
- Potential for test messages ‘escaping’ to the AFTN

Consider ‘dual-feed’ testing

- FAA suggests running parallel test AMHS with AFTN traffic
- Provides AMHS addressing shake-out
- Provides opportunity for operator training

Observation – AMHS Addressing

AMC 28-day AIRAC cycle updates:

- Day 14: Changes identified and posted to bulletin board
- Day 21: Data moved to pre-operational area
- Day 24: Data moved to operational area for download
- Day 28: Implementation at 1100UTC (Thursday)

Legacy AFTN addressing

- Prepare for dealing legacy custom routing

SITA Support (new)

- SITA seeks to deploy AMHS MTA
- Lots of customized addressing in the AMC database

Observation – Needs Coordination

- Lots of people involved in each AMHS project
  - Increases the complexity of getting the right people at the right time in the right place
- Teleconferences
  - Every 3 weeks during slow phases
  - Weekly during heavy periods (testing, cutover, etc..)
- Establish Points of Contact
  - Project scheduling and document exchange via POCs.

Success

MET XML Testing with AMHS

XML Introduction

- ✓ Since 2010, FAA has had activities with international partners to perform validation and problem isolation using XML data in an AFTN/AMHS environment.

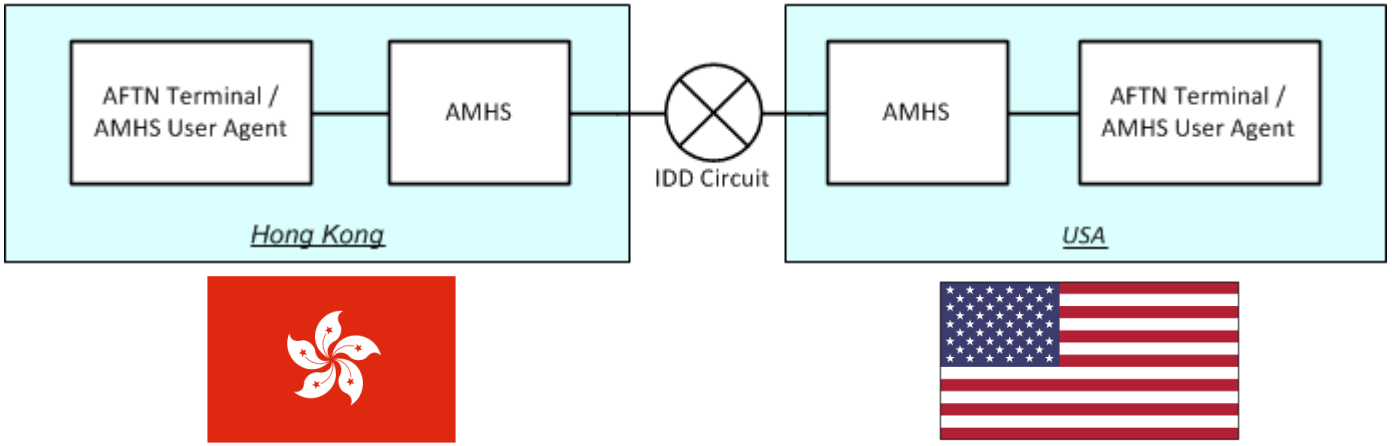
- ✓ The work began in a very basic fashion and has increased in scope with widening international participation as well as expanding capabilities.

Timeline of XML Activities

- ✓ 2010: Test between USA and Hong Kong China
  - XML data to/from FAA and Hong Kong AMHS and AFTN systems
  - Canned data, extracted from WXXM Primer
- ✓ 2012: Test between USA, UK and Singapore
  - XML data to/from FAA and Singapore, via the UK AMHS
  - Same data as above
- ✓ 2015: Test between USA, UK and Singapore
  - Same 2012 test, but introduced Singapore MET system
  - Data generated by Singapore MET system and sent for AMHS for transmission to FAA via UK

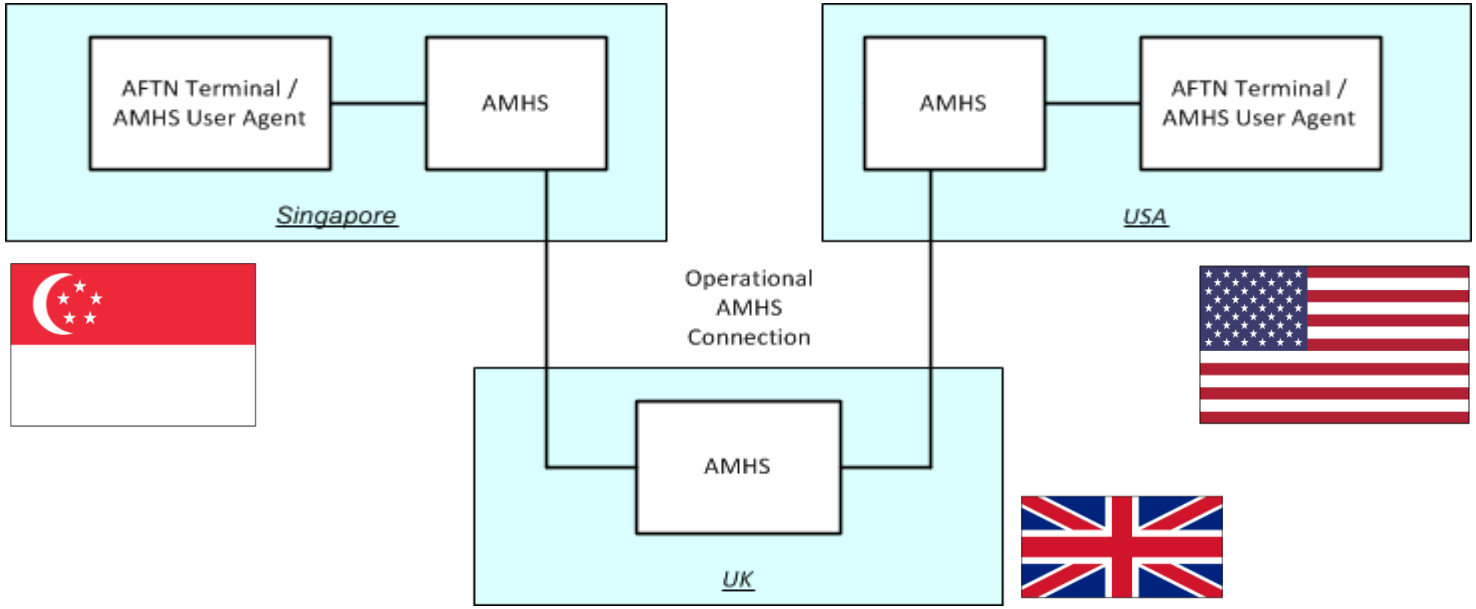
2010: USA / Hong Kong China

- ✓ Transmission of XML data to/from FAA and Hong Kong AMHS and AFTN systems
- ✓ Used canned data, extracted from FAA/EUROCONTROL WXXM Primer
- ✓ Data was sent/received using various combinations of AFTN Terminals & AMHS User Agents as end systems
- ✓ Enabled users to measure the effects of XML within AFTN, AMHS, and mixed environments



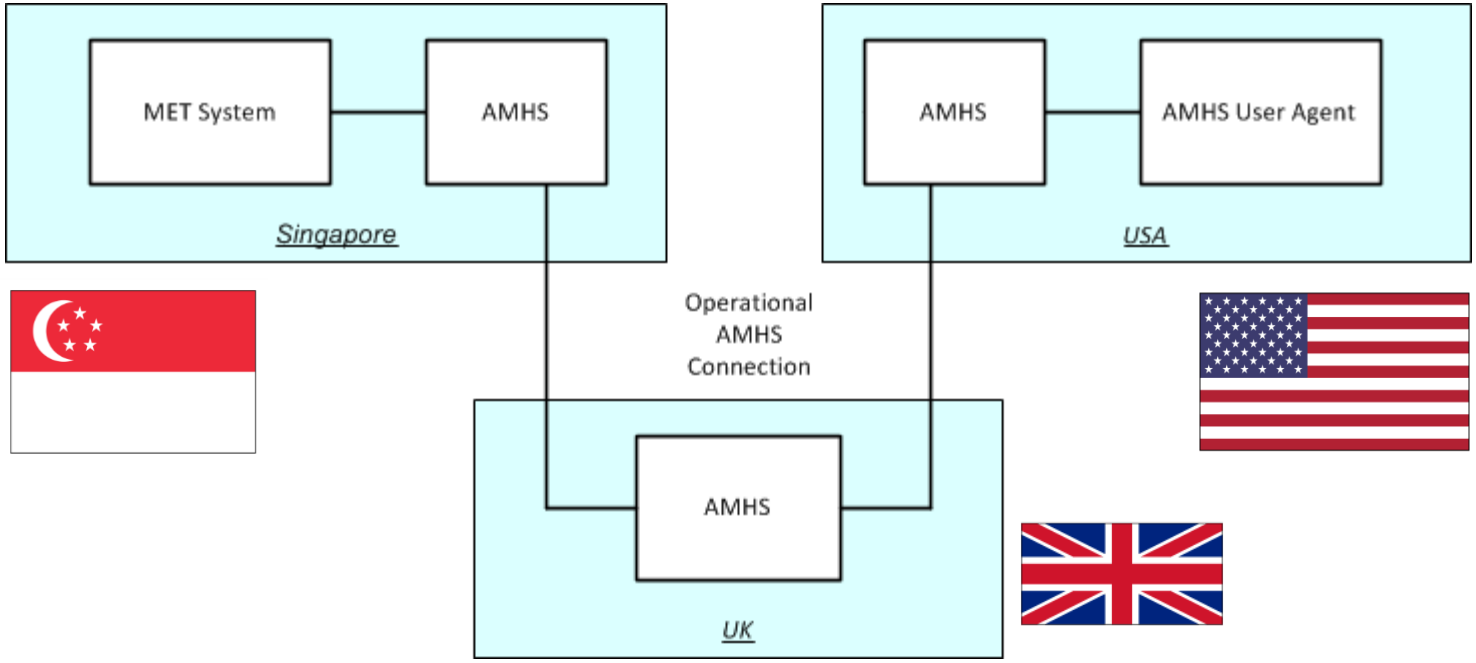
2012: USA / UK / Singapore

- ✓ Transmission of XML data to/from FAA and Singapore AMHS and AFTN systems via UK AMHS system
- ✓ Used canned data, extracted from FAA/EUROCONTROL WXXM Primer
- ✓ Data was sent/received using various combinations of AFTN Terminals & AMHS User Agents as end systems
- ✓ Enabled users to measure the effects of XML within AFTN, AMHS, and mixed environments



2015: USA / UK / Singapore

- ✓ Transmission of XML data to/from FAA and Singapore AMHS and AFTN systems via UK AMHS system
- ✓ Data was generated by their MET system and sent into their AMHS for transmission to FAA
- ✓ Allowed for use of much more realistic data than previous tests



XML Conclusions So Far

- ✓ AMHS provides a suitable platform for transmission of XML data
- ✓ AFTN has limitations, and requires and understanding of specific systems involved:
  - ✓ An AFTN system used for disseminating XML-encoded data should support the full IA-5 character set, in order to avoid the rejection of some characters.
  - ✓ An AFTN system must be capable of configuration for line length > 69 chars.
  - ✓ AFTN messages have a size limitation of 1800 characters.
- ✓ Need to know where a message will be traveling prior to issuance i.e. will the message go through an AFTN system?

THANK YOU

HAVE A SAFE JOURNEY HOME