SUNHILLO
Data Communications for Air Traffic Control

Operational FAA Surveillance Data Network

Dave Whitman

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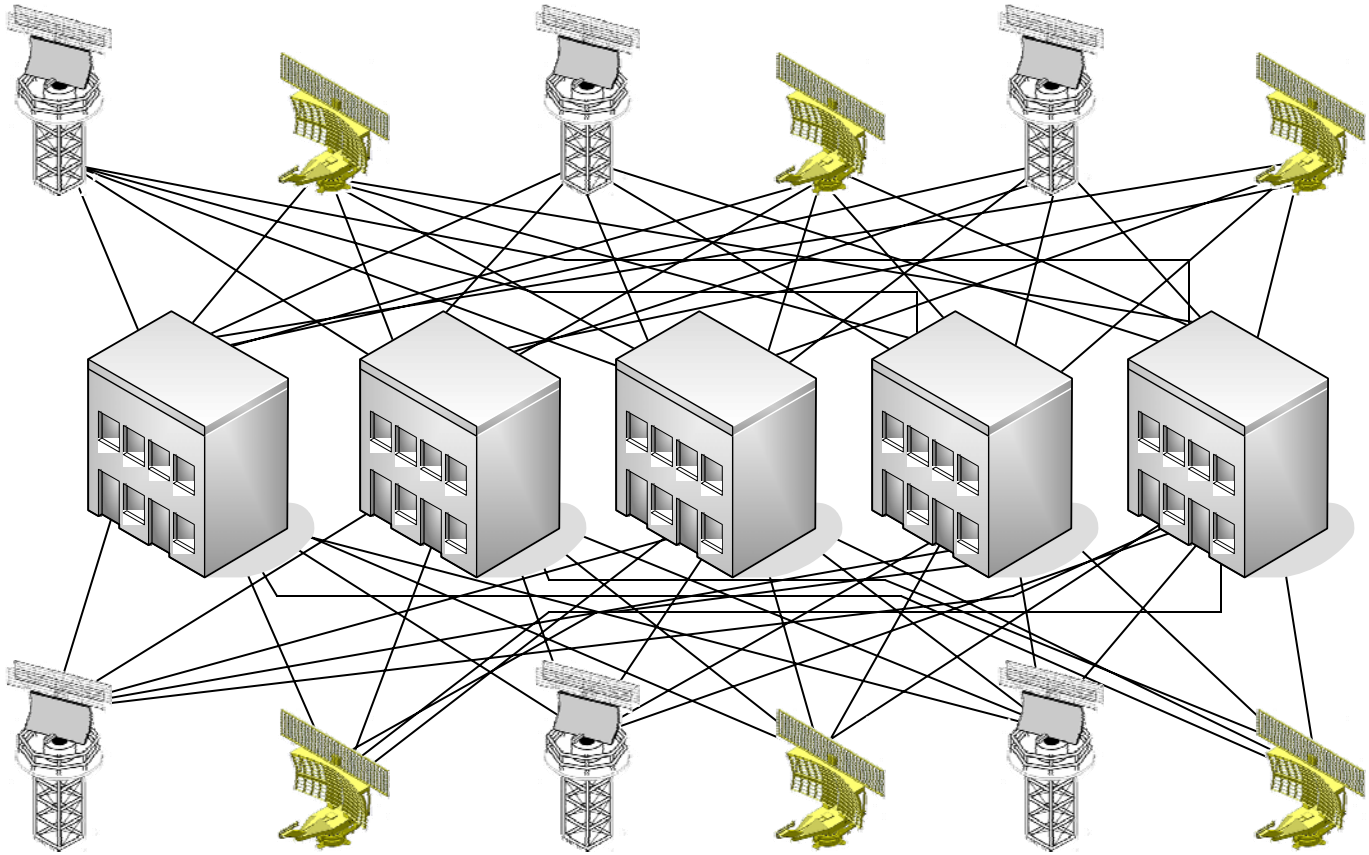
Overview

- An FAA Surveillance Data Network (SDN) currently exist.
- Currently all of the FAA Long Range Radar is being multicast across the US.

Current FAA Surveillance Architecture

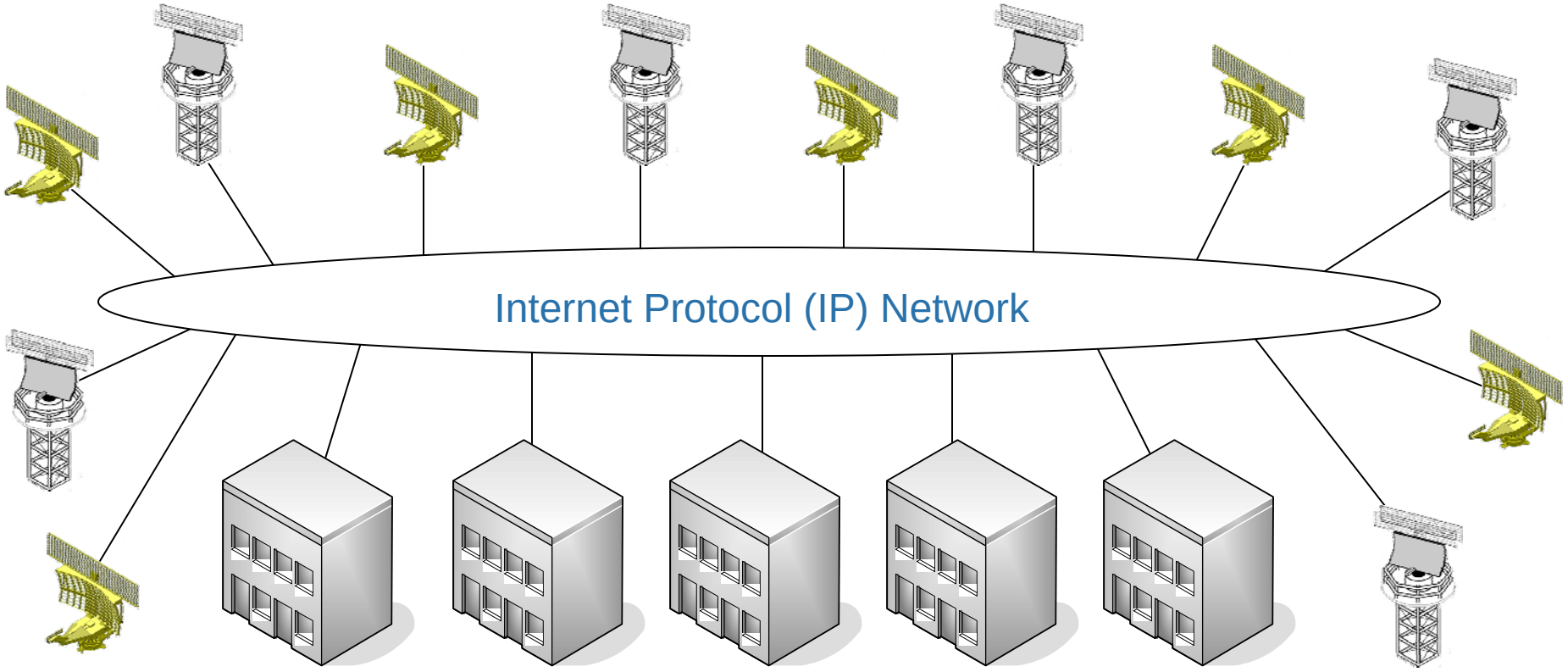
- Three point to point 2400 baud lines from each radar site to multiple ARTCCs and Tracons. Multiple sites for overlap in coverage
- Future systems such as ADS-B, SWIM, and NGATS assume an IP (i.e. no serial) interfaces for Surveillance data

Existing Point-to-Point Architecture was not Conducive to the Remote Sharing of Data



Note that each line above represents at least 3 dedicated leased lines

Networked IP-Based Architecture



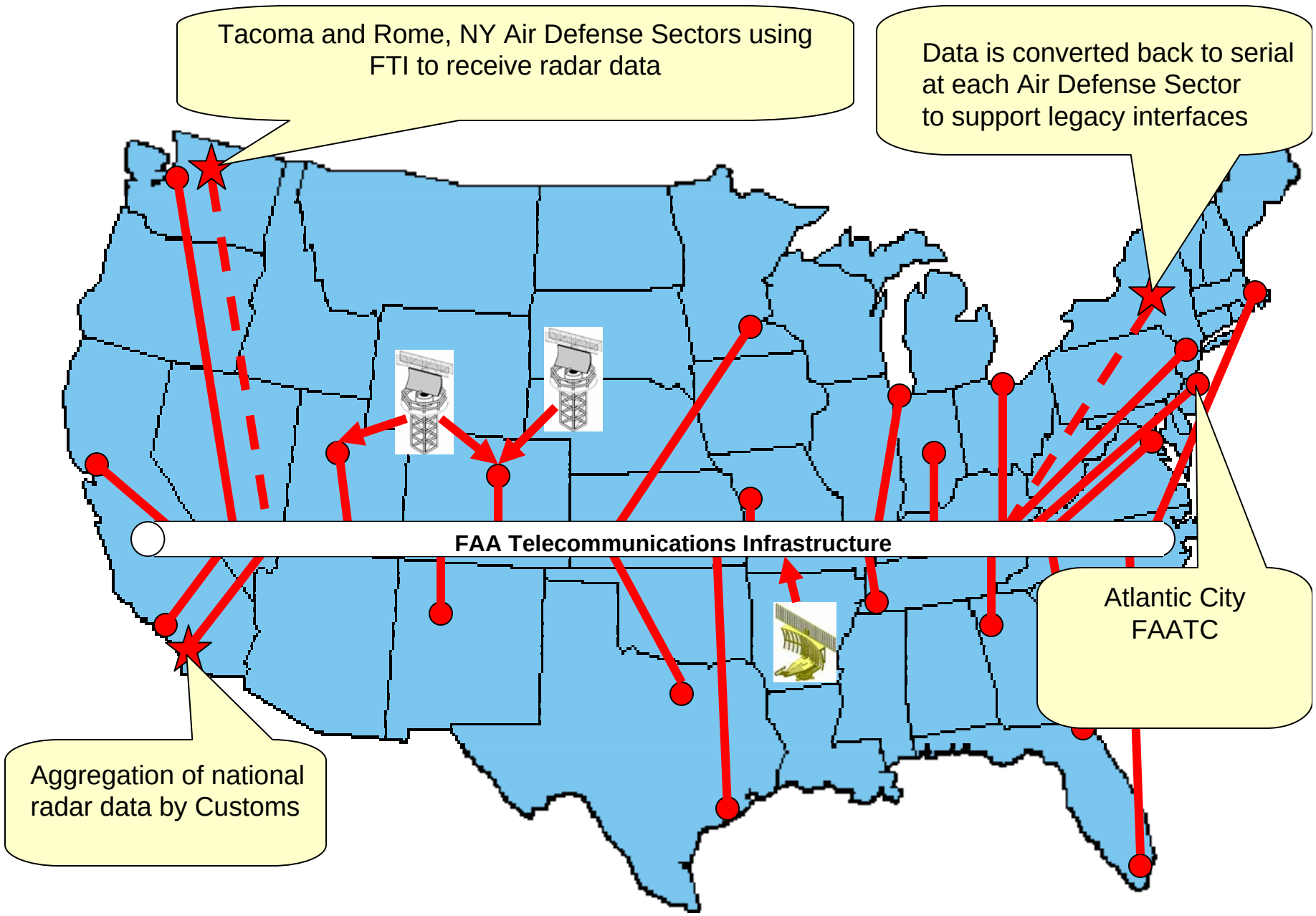
Note that each line above represents a standard Ethernet IP connection

Current FAA Surveillance data Network

- Since 2005 all FAA long range and a number of short range radars have been IP multicasted on the internet.
- All Enroute Centers (ARTCCs) are sending all of their surveillance data
- Total 133 Long range ASR4
- 40 short range ASR9/11

Current Non FAA Surveillance Customers

- US Customs
  - March Airfield, California
- The USAF Air Defense Sectors
  - Tacoma Washington
  - Rome, New York


Tacoma and Rome, NY Air Defense Sectors using FTI to receive radar data
Data is converted back to serial at each Air Defense Sector to support legacy interfaces
FAA Telecommunications Infrastructure
Atlantic City FAATC
Aggregation of national radar data by Customs

Architecture

- FTI is providing dual homed feeds from all 20 ARTCCs
- Redundancy is achieved by multiple centers multicasting the same radar
- Of 133 ASR4s only 48 go to only a single ARTCC
- Data bandwidth is > than 5Mbits/sec

Latency

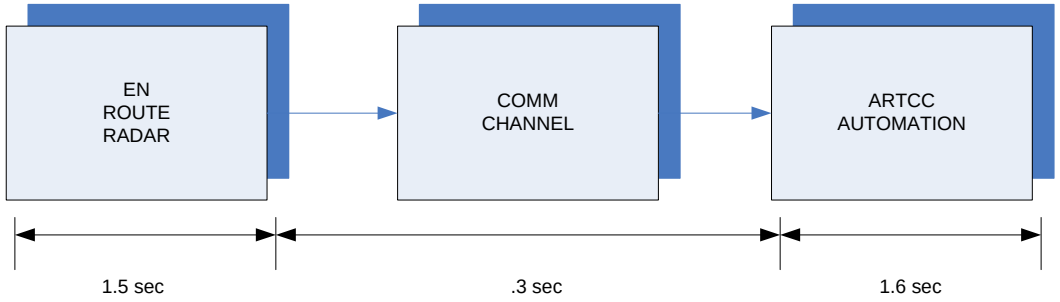
- FAATC has recently begun to measure the reliability and latency of the multicast data
- Comparison with direct modem connection to radar delta is 40ms avg for mulitcast of data.
- Have successfully ran NAS Host with IP feed into ECG as a part to Business Continuity Plan

Latency

- According to NAS-SS-1000 the Surveillance thread requirement is 3.5 seconds
  - Defined as the time the target enters the boresight of the ARSR antenna until it appears on the Display Console

Latency

En Route Surveillance String Latency Allocations
With .1 second margin



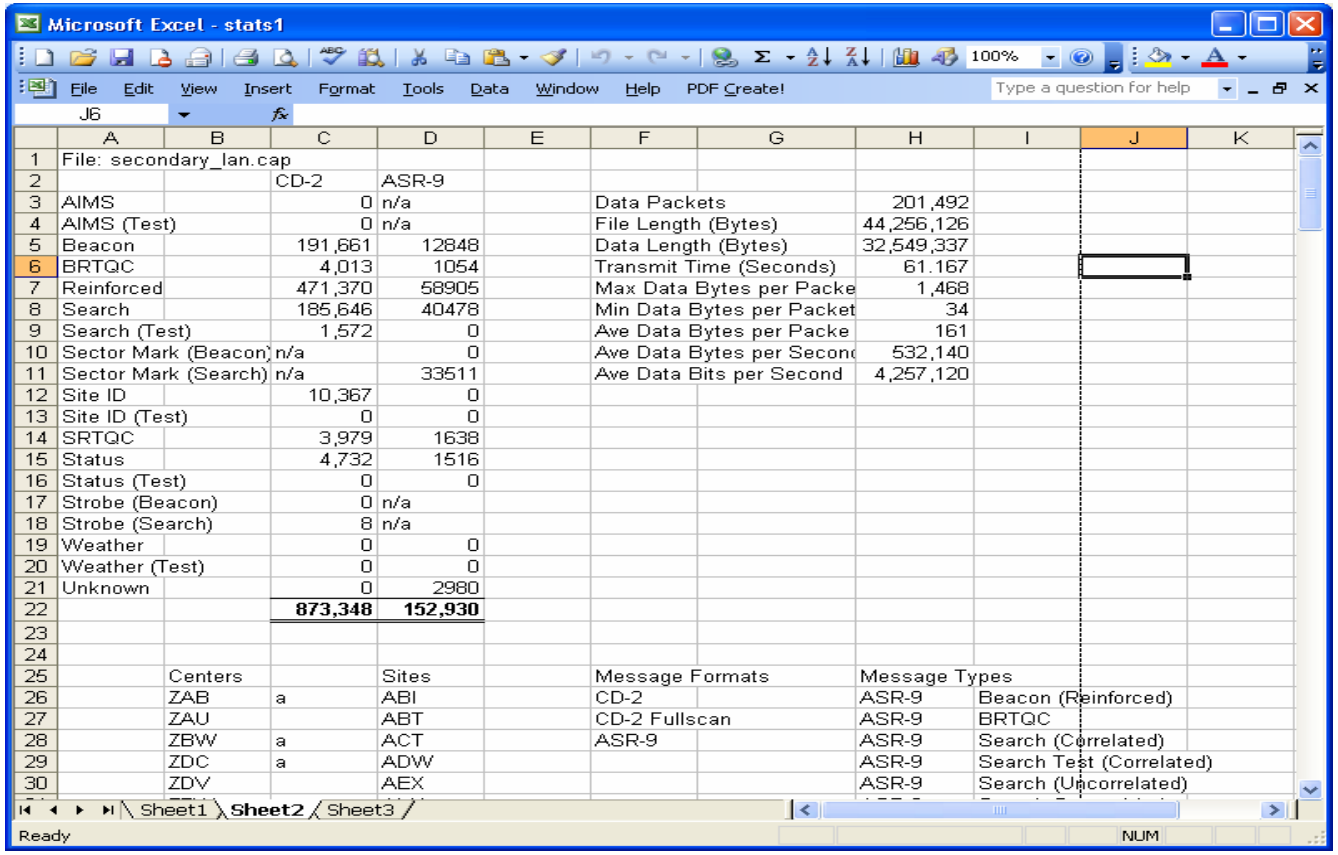
ASRS Latency

- Radar Latency
  - Mainly caused by queuing because of the slow 2400 baud rate
- Communication channel
  - Slow baud rate 45ms for CD Beacon
  - Slow modems (2* 30ms) = 60 ms
- ARTCC Automation
  - Host and DSR

US Combined Surveillance 1 minute Analysis

- Ave Data Bits / Second 4,279,016
- Total CD-2 messages 876,345
- No weather was transmitted
- 224 Total Sites

US Combined Surveillance 1 minute Analysis



Microsoft Excel - stats1

File Edit View Insert Format Tools Data Window Help PDF Create! Type a question for help

J6

	A	B	C	D	E	F	G	H	I	J	K
1	File: secondary_lan.cap										
2			CD-2	ASR-9							
3	AIMS		0	n/a		Data Packets		201,492			
4	AIMS (Test)		0	n/a		File Length (Bytes)		44,256,126			
5	Beacon		191,661	12848		Data Length (Bytes)		32,549,337			
6	BRTQC		4,013	1054		Transmit Time (Seconds)		61.167			
7	Reinforced		471,370	58905		Max Data Bytes per Packe		1,468			
8	Search		185,646	40478		Min Data Bytes per Packet		34			
9	Search (Test)		1,572	0		Ave Data Bytes per Packe		161			
10	Sector Mark (Beacon)		n/a	0		Ave Data Bytes per Secon		532,140			
11	Sector Mark (Search)		n/a	33511		Ave Data Bits per Second		4,257,120			
12	Site ID		10,367	0							
13	Site ID (Test)		0	0							
14	SRTQC		3,979	1638							
15	Status		4,732	1516							
16	Status (Test)		0	0							
17	Strobe (Beacon)		0	n/a							
18	Strobe (Search)		8	n/a							
19	Weather		0	0							
20	Weather (Test)		0	0							
21	Unknown		0	2980							
22			**873,348**	**152,930**							
23											
24											
25		Centers		Sites		Message Formats		Message Types			
26		ZAB	a	ABI		CD-2		ASR-9	Beacon (Reinforced)		
27		ZAU		ABT		CD-2 Fullscan		ASR-9	BRTQC		
28		ZBW	a	ACT		ASR-9		ASR-9	Search (Correlated)		
29		ZDC	a	ADW				ASR-9	Search Test (Correlated)		
30		ZDV		AEX				ASR-9	Search (Uncorrelated)		

Sheet1 Sheet2 Sheet3

Ready NUM

Initial Experience

- System in use for 18 Months
- Current Network System Monitoring capability inadequate for surveillance coverage assurance
  - Network can be up but surveillance data missing
  - Redundancy algorithms need to be enhanced

Redundancy

- Dual Homed feeds into all centers
  - Different data is on each feed
  - Cannot just swap to other feed if data is missing
  - Must read both feeds and extract targets from both
  - Time and data order can vary from different feeds making correlation difficult

Management

- Domain knowledge is necessary to effectively manage and status the network
- Examples
  - On congestion which messages to discard?
  - On routing failures redundant data may exist elsewhere
  - Should status service not networks

Summary

- There EXISTs an SDN now
- It is a resource that can be used to study future systems:
  - ADS-B
  - SWIM
  - NGATS