AIDC Lessons Learned – U.S. and Canada

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Automation Lessons Learned

- The increasing demand of international traffic between Flight Information Regions (FIR) drives the need to improve efficiency through automation while maintaining the data accuracy needed for the Air Traffic Control (ATC) providers.

- Developing a harmonized process and using standardized protocols for exchanging accurate data across regions is critical to achieving efficiency through automation.

- Sharing automation lessons learned increases the regional member state knowledge and cumulative implementation expertise.

US and Canada Automated International Boundaries

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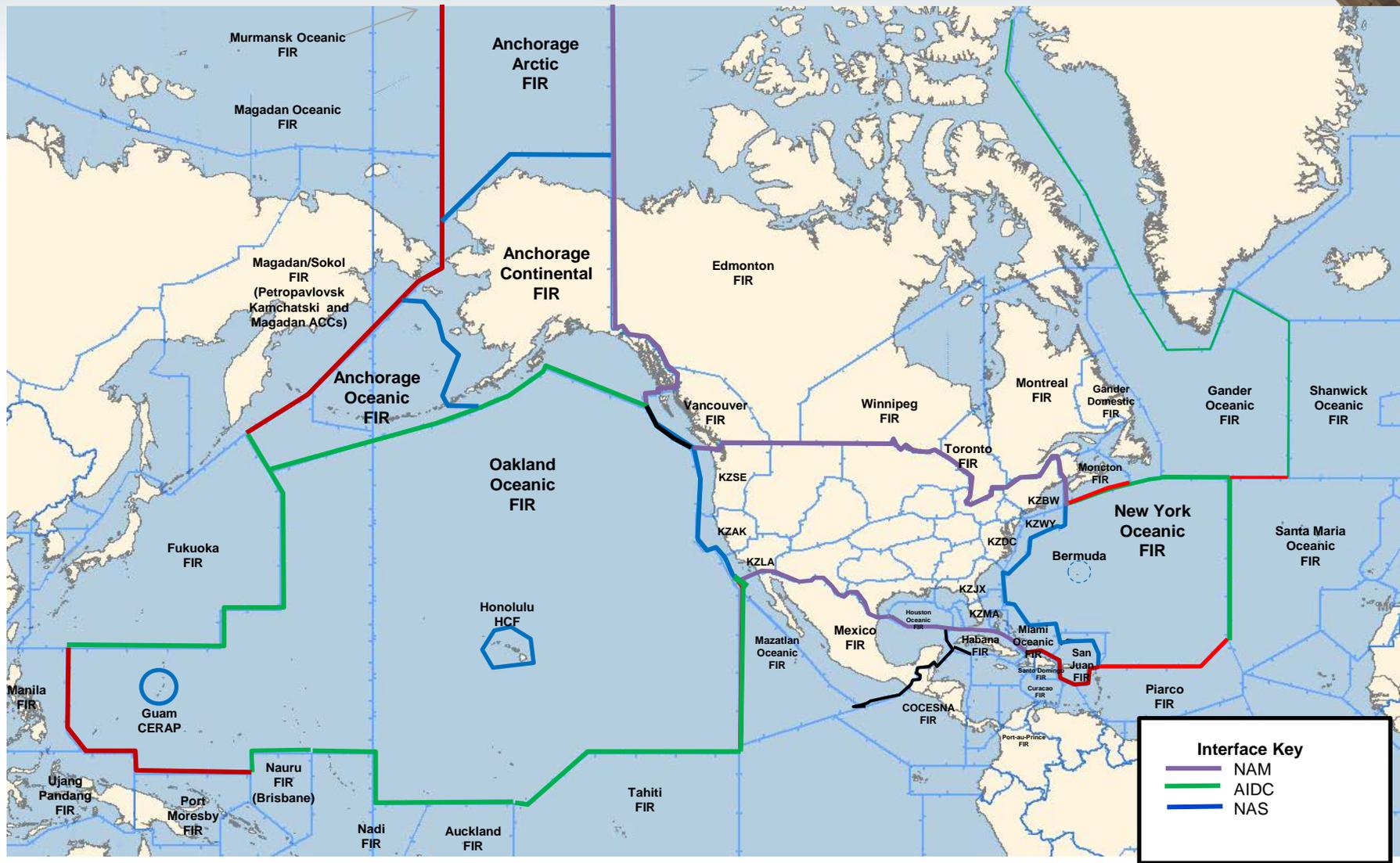
US - Canada En-Route/Oceanic Automation

Anchorage ARTCC
Oceanic
ATOP

Canada
CAATS
Domestic

Canada
GAATS
Oceanic

ERAM
Domestic ARTCCS

Oakland ARTCC
Oceanic
ATOP

New York ARTCC
Oceanic
ATOP
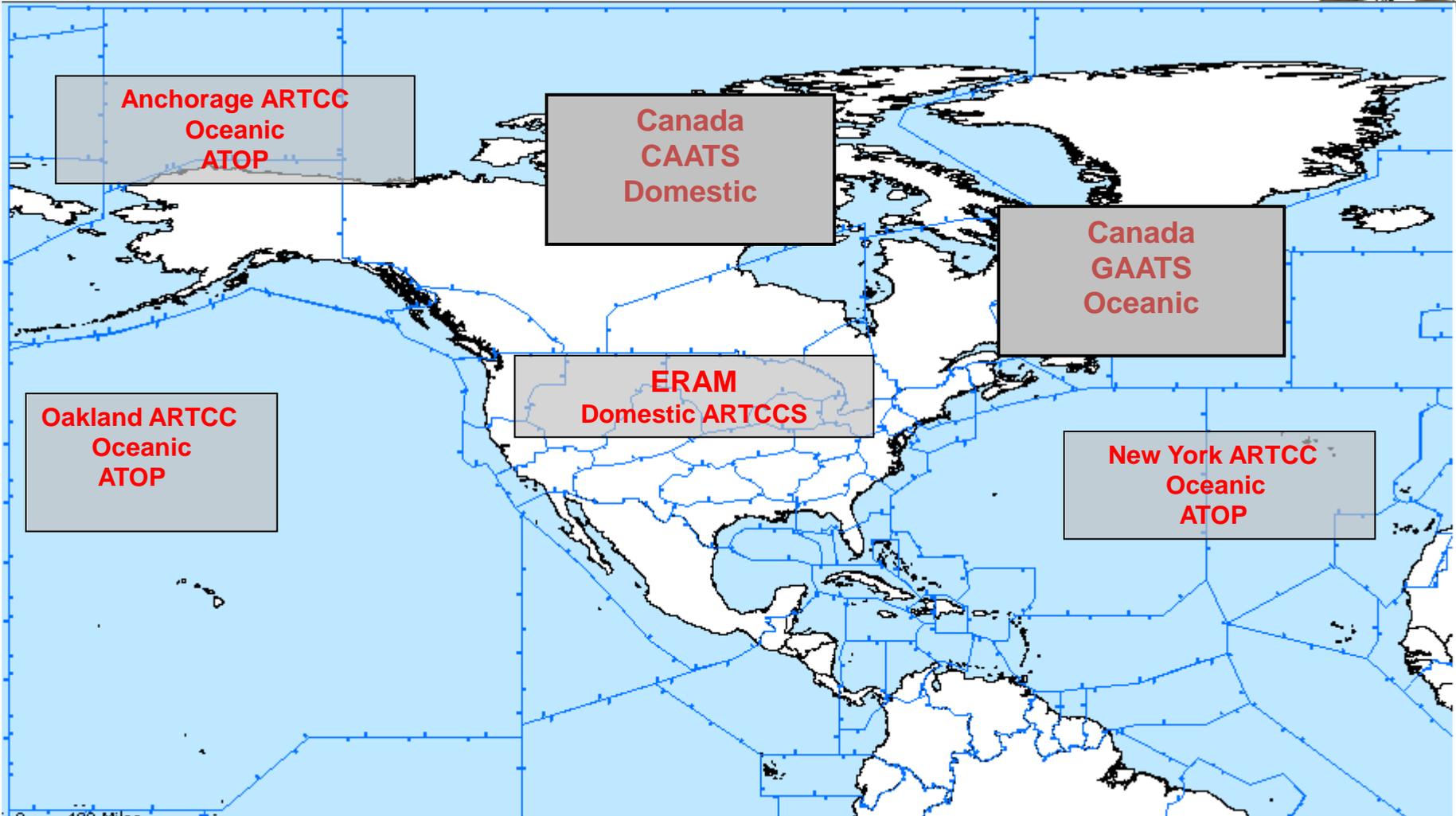
Border Crossings

- **Traffic that transit US – Canada borders is one of the highest traffic levels in the world**

US International Border Crossings				
Neighboring FIR	**CY 2012 Number of crossings**	**CY 2013 Number of crossings**	**CY 2014 Number of crossings**	**CY 2015 Number of crossings**
Canada FIRs	2,489,122	2,513,329	2,556,999	2,409,602
Mexico FIRs	390,280	402,499	413,821	407,738
Habana	230,212	233,922	241,641	242,794
Japan	125,961	130,515	133,490	131,709

Canada FIRs	**2,489,122**	**2,513,329**	**2,556,999**	**2,409,602**

SantaMaria	72,281	73,459	76,726	75,750
PortAuPrince	46,090	47,978	49,886	45,792
Russia FIRs	39,665	39,894	40,365	41,409
Maiquetia	11,948	13,536	13,338	13,082
Port Moresby	10,721	10,672	10,770	10,204
Auckland Oceanic	6,463	7,250	7,580	7,936
Curacao	6,054	5,941	6,519	6,848
Manila	5,794	5,565	6,184	6,550
Nadi	2,703	2,941	3,104	2,839
Tahiti	2,984	2,571	2,791	2,630
Nauru	552	609	618	711
Ujung Pandang	255	224	235	219
Grand Total	**3,609,476**	**3,664,647**	**3,750,889**	**3,585,071**

U.S. - Canada Domestic/Oceanic Interfaces
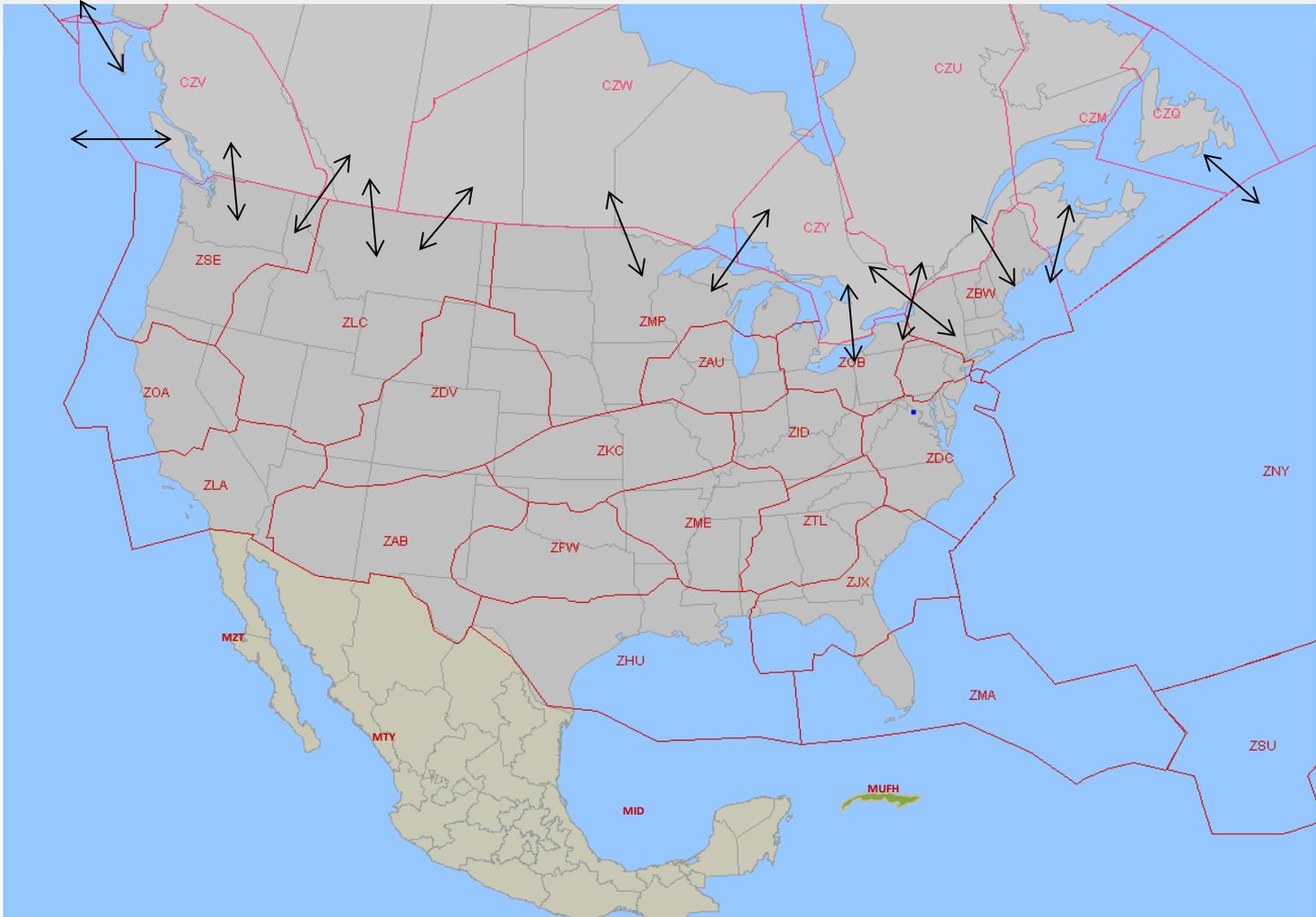
Operational AIDC Cross Border Automation

- Cross Border Automation has been implemented between 14 NAM FIR/ACC pairs between Canada and US and one AIDC pair.

  - NAM Canada – US 14

    - Domestic 11   (CAATS – ERAM)
    - Alaska   2   (CAATS – FDP2K)
    - Oakland Oceanic - Vancouver ACC (ATOP – CAATS)

  - AIDC Canada – US 1
   - Gander Oceanic – New York Oceanic (GAATS+ - ATOP)

Using AIDC and NAM in Automated Data Exchange

- AIDC functionality described Asia Pacific and North Atlantic ICDs; now PAN ICD
    - Provides the needed guidance for messaging, coordination and transfer to support non-radar/procedural environments such as oceanic operations.
    - It can be confusing when these primarily domestic environments as such are referred to as AIDC.
- The NAM ICD is currently used in North American FIR boundary operations, in domestic/oceanic transition areas and in surveillance environments.
    - Many times operations do not fit neatly into one category protocol or the other
    - Many systems today will allow interface protocols to be tailored to a particular interface; NAM or AIDC, systems also support both .
- A full set of messages may not be needed to achieve automated flight data exchange for a particular interface.
    - Protocols which can support incremental levels of functionality provides tremendous implementation flexibility; AIDC and NAM are used in US International interfaces
    - Supports a reduced set of interface messages

AIDC – From a NAV CANADA Point of View
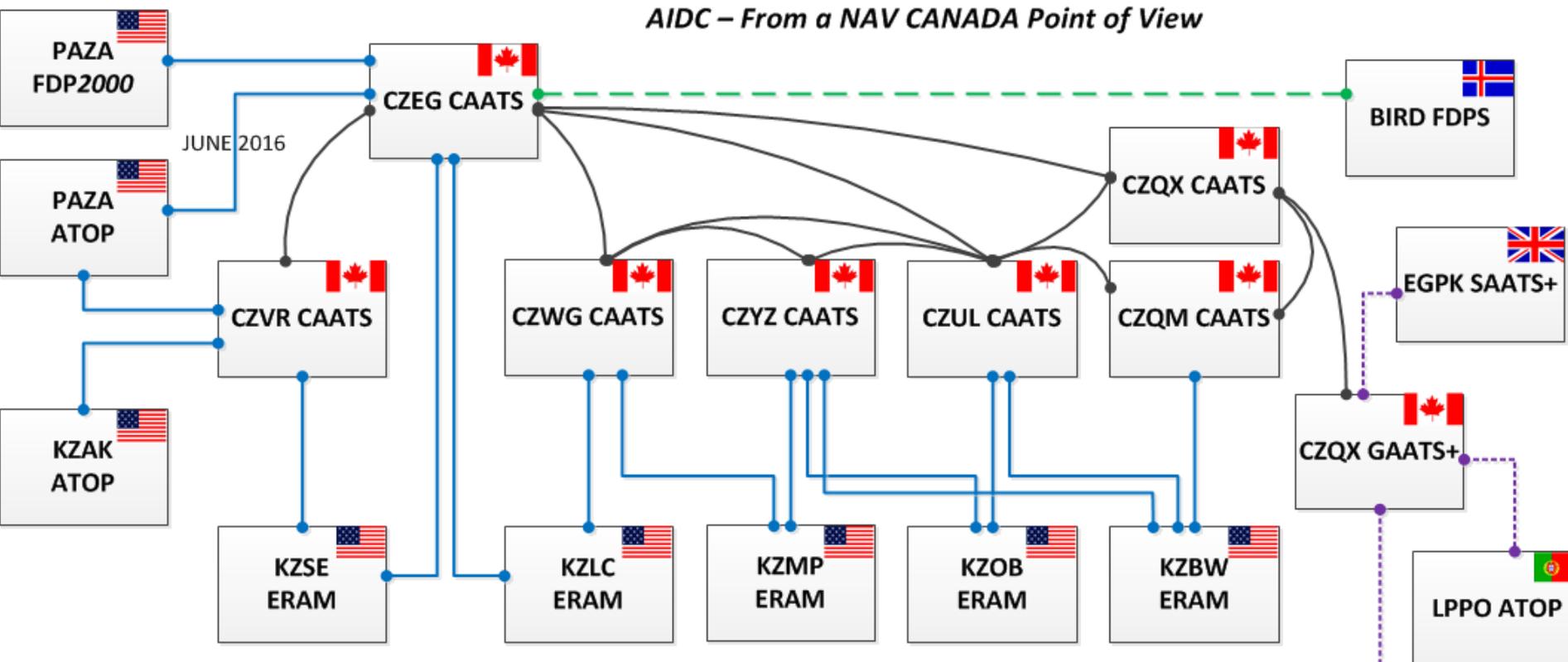
NAMICD
FPL
CHG
CNL
EST
CPL
MOD
MIS

NATCC ICD
ABI
FPL
MAC
CPL
ACP
REJ
CDN
MIS
EMG
NAT OTS

CUSTOM (NATCC BASED)
ABI
FPL
MAC
CPL*
ACP

* Only one CPL sent then manual coordination required on subsequent modifications

ACC-ACC
FPL
DLA
CHG
CNL
DEP
ARR
CPL
HO/TOC
RMK
XML

NAMICD – North American Interface Control Document

NATCC – North Atlantic Common Coordination Interface Control Document

ACC-ACC – CAATS Intersegment Interface Control Document

AIDC Lessons Learned

...oint is impossible

...les some automation but

...coo

– Ingrained ... can be di...

– Controllers abilit... to i...
takes time and each individual ...

'Our plan for manual verification of automatic estimate distribution when we implemented CAATS was to manually verify for 10 days. I think we lasted into the 3rd day when manual verification was suspended.

Recently we implemented AIDC with OAK and they require manual verification (part of their requirements) – there is no current timetable to cease manual verification.

I will comment that if OAK would have allowed it, our controllers would have been comfortable trusting a new automated link after an hour'.

Vancouver FIR

'Our initial plan was to use a manual confirmation process for up to a week to validate the accuracy of the data.

In most cases we were actually only on it for 48 max, and in some cases for less than 36 hours.

Once we had validated data from a couple hundred flights, controllers were pretty comfortable in moving away from manual coordination'.

Edmonton FIR

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AIDC Lessons Learned

- Provide as much visual feedback as possible
  - First provide feedback that data is being transmitted

    - In Canada we used mnemonics on the label to indicate when a message was sent successfully
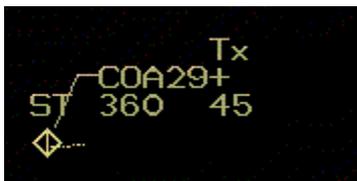
Transmitted CPL/MOD: success
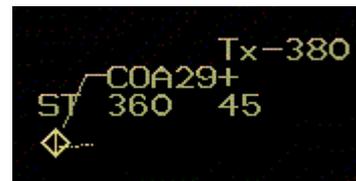
Tx – 380
Transmitted CPL/MOD success: coordinated level F380

    - This built confidence in the automation, controllers did not have to guess when or if messages had been sent

AIDC Lessons Learned

- ## Guide the controllers actions

    - For Class 1 visual cues were required to remind controllers to follow up on coordination

        - Introduced mnemonics on the label to indicate when flight data changed and manual coordination was required

MOD: Flight Data modified, manual
coordination required

AIDC Lessons Learned

- ## Guide the controllers actions
  - A dialog box indicating what the required coordination is was provided with a mechanism to clear the MOD

MOD: Data in green changed and
requires manual coordination

AIDC Lessons Learned

- Be clear about when data will not be passed automatically

  - When a flight has left the airspace (according to the calculated trajectory) automatic distribution ends, controllers at times did not understand this concept

 - Introduced mnemonics on the label to indicate when flight data distribution was not occurring

TxF: Automatic Transmission of Data Finished

AIDC Lessons Learned

- Most important lesson was; tell a controller when something has gone wrong

  – Be clear when/why a message has not been distributed

    – Visual indicators provided instant notification that something needed action worked far better than having controllers look through lists for information

**TxP**: Transmission pending, data sent but rejected by downstream facility

Err: Transmission failed, interface in failed state

AIDC Lessons Learned

- Consistent procedures are a must when things go wrong
    - Ensure controllers know what to do when a message fails
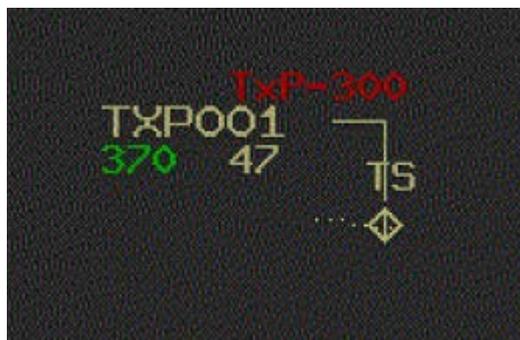
    – Re-send?

    – Wait?

    – Manually coordinate?

   – Call Tech-Ops?

    – Call flight data section?

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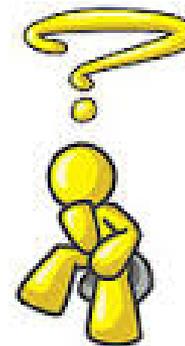
AIDC Lessons Learned

- Sometimes the automation is wrong, so ensure the controller can override the system to keep traffic flowing

    - Allow forcing of estimates before scheduled times and manual coordination
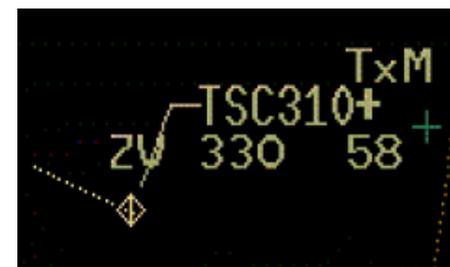
TxM: Transmitted via Manual Coordination

AIDC Lessons Learned

- Consistent reliable data exchange relies on complex automation to support it

- System behaviour changes or new functions can affect data exchange
  - Can augment it, or
  - Can also break a working model

- Proceed with caution when making changes and test as much as possible using as many scenarios as required to capture all possible operational cases

- Be prepared to roll-back, data exchange <u>is that</u> critical

AIDC Lessons Learned

- Be prepared for less throughput when automatic data distribution is not available

  - Controllers are not as efficient with manual coordination as they used to be

  - Staffing may be lower in a given period of the day due to efficiencies gained by automatic data exchange making it difficult to handle the same traffic manually

  - Ensure controllers are clear on how and who they need to coordinate with when automation is not available

AIDC Lessons Learned

- Train your controllers to manually coordinate and practice (why?)

  - Controllers will forget how to manually coordinate as time wears on

  - Newer controllers may never have to 'pass an estimate' once they leave the school

  - In some specialties trainees are no longer taught to manually coordinate as a core part of their job

  - It is difficult to remember for each flight who you have to coordinate with and what the rules are for coordination when the system has been doing it for you for months/years

AIDC Lessons Learned

- Impact on <u>other systems</u>

  - Implementation of NAM ICD between Canada/U.S. needed to support multiple systems:
    - HOST, ERAM (FAA)
    - CAATS, NFDPS, FDPN (NAV CANADA)
- AFTN initially caused many issues due to store/forward delays:
  - Winnipeg ACC experienced numerous response delays of greater than 60 seconds

- AFTN upgrades were required to create a dedicated circuit for NAMICD traffic only

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AIDC Lessons Learned

Statistics - 2008

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Federal Aviation Administration

AIDC Lessons Learned

*Statistics sample from Initial NAM ICD Operations between Toronto FIR (CZYZ) to Cleveland FIR (KZOB) April 19, 2008 03:04Z to 23:59Z			
Total unique flight plans sent via AIDC **to KZOB**	Total rejected unique flight plans sent via AIDC **to KZOB**	Total AIDC messages sent **to KZOB**	Total rejected AIDC messages sent **to KZOB**
503	69	1156	108

*Toronto ACC using CAATS, Cleveland ARTCC using HOST

CZYZ CAATS   **KZOB HOST**

Unique Flight Plans Breakdown (503)

■ Successful unique F/Ps   ■ Rejected unique F/Ps

14%

86%
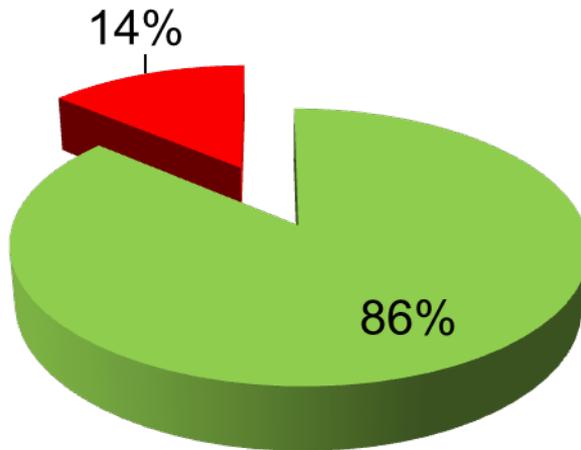
AIDC Message Breakdown (Total 1156)

■ Successful AIDC Messages   ■ Rejected AIDC Messages

9%

91%

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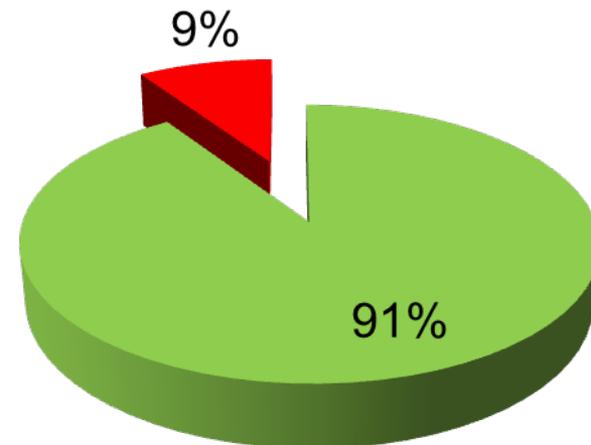
AIDC Lessons Learned

Breakdown of 69 Detected Errors on Unique Flight Plans – CAATS Outbound to FAA	CZYZ CAATS	KZOB HOST	
Duplicate Error	19		This error occurs when the estimate fix distributed to the FAA is: earlier than the last converted fix in the YZ airspace that the HOST has calculated; or is a true duplicate because the FAA has already entered the segment locally. This primarily occurs due to differences in airspace definition between CAATS and the FAA.
MOD Invalid on Tracked Aircraft	18		This error was due to an issue in FAA HOST when the Mode C cannot be determined. If a MOD is received during this time it will be rejected.
No Flight Plan	10		Error occurs when the flight plan is not in the HOST database (or cannot be matched).
Flight not Inbound	4		This occurs when a CPL is received with an estimate that is within the FAA airspace. Primarily occurs in areas where there is a discrepancy in the airspace definition.
EET	7		Flight plans filed with an EET keyword with no data are rejected by FAA when a MOD is sent. EGF is only airline that files this way.
WTC	1		BE40 was sent with WTC L, FAA has it as M.
Other Reasons	11		MOD sent with an estimate of 2139 at BULGE when the current time was 2139:10. FAA rejected since time was in the past. (2 rejections of this nature) 3 CHG rejections. This was an FAA issue that was corrected. 2 rejections for fix BORNE011003 rejections. 2 EST rejections due to FAA user changing beacon code. KITOK324017 selected for ECK J38 route. Data change required.

Breakdown of F/P Errors (69)

- Duplicate Error
- MOD Invalid Tracked A/C
- No Flight Plan
- Flight Not Inbound
- EET
- WTC
- Other
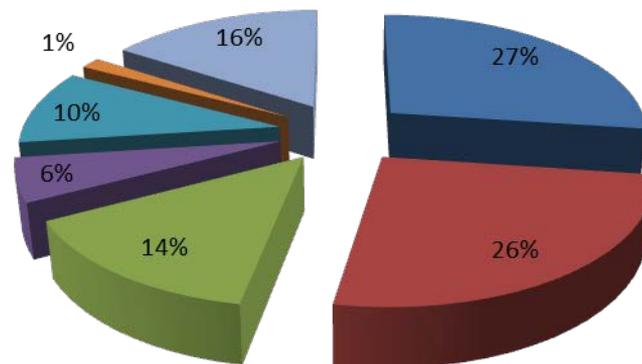
1% — 16% — 27% — 26% — 14% — 6% — 10%

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AIDC Lessons Learned

*Statistics sample from Initial NAM ICD Operations between Toronto FIR (CZYZ) to Cleveland FIR (KZOB) April 19, 2008 03:04Z to 23:59Z

Total unique flight plans sent via AIDC **to CZYZ**	Total rejected unique flight plans sent via AIDC **to CZYZ**	Total AIDC messages sent **to CZYZ**	Total rejected AIDC messages sent **to CZYZ**
479	53	1282	75

*Toronto ACC using CAATS, Cleveland ARTCC using HOST

CZYZ CAATS   **KZOB HOST**

Unique Flight Plans Breakdown (479)

■ Successful unique F/Ps   ■ Rejected unique F/Ps

11%

89%
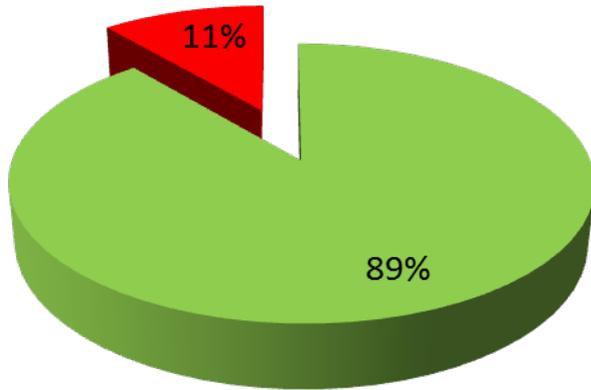
AIDC Message Breakdown (Total 1282)

■ Successful AIDC Messages   ■ Rejected AIDC Messages
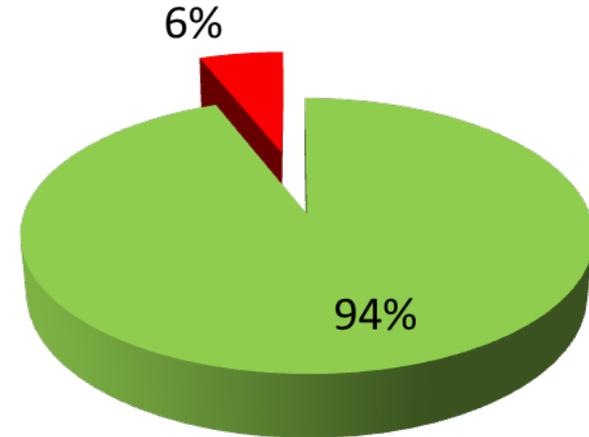
6%

94%

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AIDC Lessons Learned

| Breakdown of 53 Detected Errors on Unique Flight Plans – CAATS Inbound from FAA	CZYZ CAATS		KZOB HOST
FP Not Your Control	41	Occurs when a MOD is received and CAATS has already taken jurisdiction of the aircraft.	
Unknown Aerodrome	4	SPIM, EKM, OWK, SUA, 3BS were not in the adaptation data at the time.	
Invalid Field 18 Syntax	1	General syntax error	
Duplicate Flight Plan	3	This was a problem with old data on interface start-up.	
EST received with estimate prior to profile start	1	This was due to KBUF departures with BUF estimate. BUF could not be applied abeam the trajectory, has been resolved.	
Multiple Flight Plans	1	Flight plan received with ZZZZ as aerodrome and has multiple legs. CAATS cannot determine which flight to uniquely apply message to.	
Invalid Airway	1	Airway not in adaptation at the time	
Unknown	1	Did not know the cause at the time and detailed SW investigation was required.	

Breakdown of F/P Errors (53)

■ FP Not Your Control ■ Unknown Aerodrome
■ Invalid Field 18 Content ■ Duplicate Flight Plan
■ EST ■ Mulitple Flight Plans
■ Invalid Airway

Pie chart values: 77%, 7%, 2%, 6%, 2%, 2%, 2%, 2%

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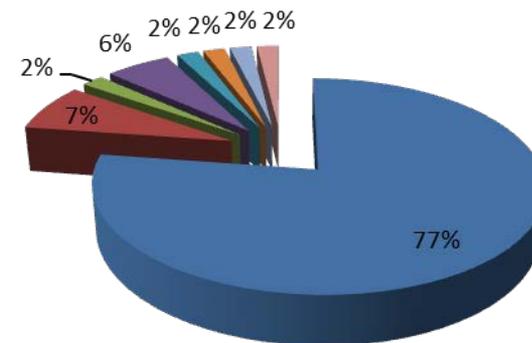
AIDC Lessons Learned – AFTN 2008

AIDC Traffic Stats and AFTN Latency on January 5th, 2008 from Montreal FIR (CZUL) – overnight period	
Total Number of Messages	410
Total Number of Messages Accepted	347
Total Number of Messages Rejected	63
Minimum Delay in Seconds	4.0s
Maximum Delay in Seconds	62.0s
LAM received within 3s	0
LAM received within 5s	26
LAM received within 7s	209
LAM received within 10s	140
LAM received within 20s	27
LAM received within 30s	5
LAM received within 60s	1
LAM received within 120s	1
LAM received within 180s	0

AFTN Latency

Pie chart values: 0.24, 0.24, 0, 0, 1.2, 6.6, 6.3, 34.1, 51

Legend: 3s, 5s, 7s, 10s, 20s, 30s, 60s, 120s, 180s
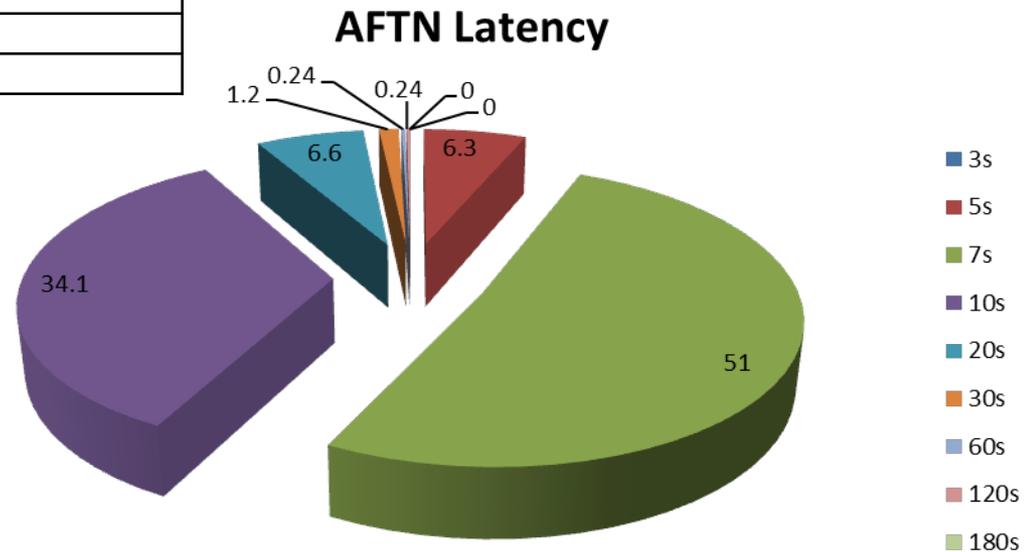
AIDC Lessons Learned

Statistics - 2015

AIDC Lessons Learned

| *Statistics sample from Initial NAM ICD Operations between Toronto FIR (CZYZ) to Cleveland FIR (KZOB) August 20th, 2015 05:32Z to 23:59Z			
Total unique flight plans sent via AIDC **to KZOB**	Total rejected unique flight plans sent via AIDC **to KZOB**	Total AIDC messages sent **to KZOB**	Total rejected AIDC messages sent **to KZOB**
641	24	1510	29

*Toronto ACC using CAATS, Cleveland ARTCC using **ERAM**

Unique Flight Plans Breakdown (641)

■ Successful unique F/Ps   ■ Rejected unique F/Ps

4%

96%
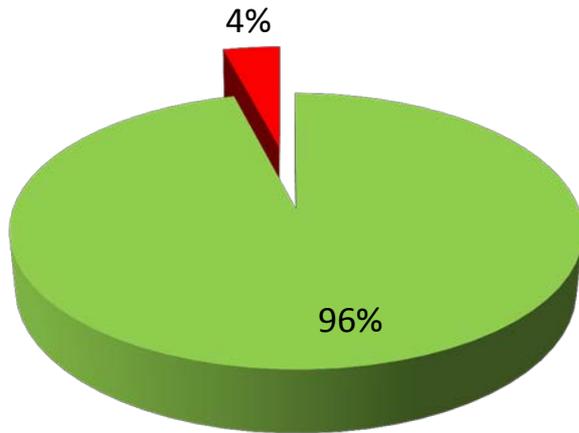
AIDC Message Breakdown (Total 1510)

■ Successful AIDC Messages   ■ Rejected AIDC Messages

2%

98%
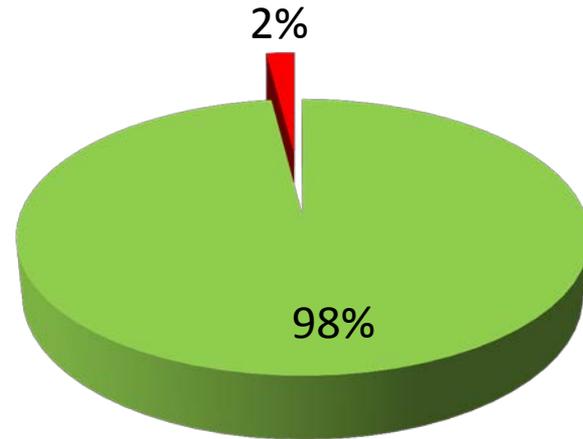
AIDC Lessons Learned

Breakdown of 29 Detected Errors on Unique Flight Plans – CAATS Outbound to FAA	CZYZ CAATS		KZOB ERAM
Duplicate Error	4	This error occurs when the estimate fix distributed to the FAA is: earlier than the last converted fix in the YZ airspace that the ERAM has calculated; or is a true duplicate because the FAA has already entered the segment locally. This primarily occurs due to differences in airspace definition between CAATS and the FAA.	
MOD Invalid on Tracked Aircraft	13	This error was due to an issue in FAA ERAM when the Mode C cannot be determined. If a MOD is received during this time it will be rejected.	
CNL Invalid on Tracked Aircraft	4	This error is due to an issue in FAA ERAM when the Mode C cannot be determined. If a CNL is received during this time it will be rejected.	
No Flight Plan	4	Error occurs when the flight plan is not in the ERAM database (or cannot be matched).	
Unknown STAR	7	Error occurs when the STAR is not in the receiving site database; easily corrected with adaptation change.	

Breakdown of F/P Errors (29)

■ Duplicate Error ■ MOD Invalid Tracked A/C
■ CNL Invalid on Tracked A/C ■ No Flight Plan
■ Unknown STAR
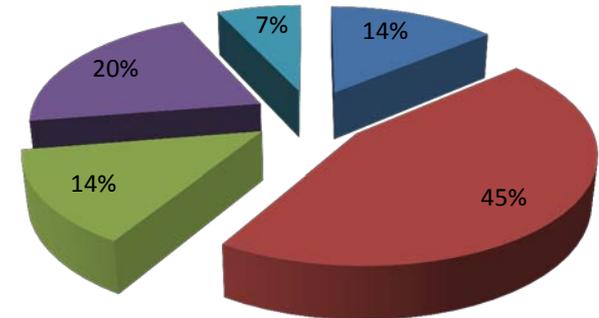
Pie chart values: 7%, 14%, 20%, 14%, 45%

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AIDC Lessons Learned

*Statistics sample from Initial NAM ICD Operations between Toronto FIR (CZYZ) to Cleveland FIR (KZOB) August 20th, 2015 05:32Z to 23:59Z				
Total unique flight plans sent via AIDC **to CZYZ**	Total rejected unique flight plans sent via AIDC **to CZYZ**	Total AIDC messages sent **to CZYZ**	Total rejected AIDC messages sent **to CZYZ**
754	84	2400	137

*Toronto ACC using CAATS, Cleveland ARTCC using **ERAM**

CZYZ CAATS   **KZOB ERAM**

Unique Flight Plans Breakdown (754)

■ Successful unique F/Ps   ■ Rejected unique F/Ps

12%

88%
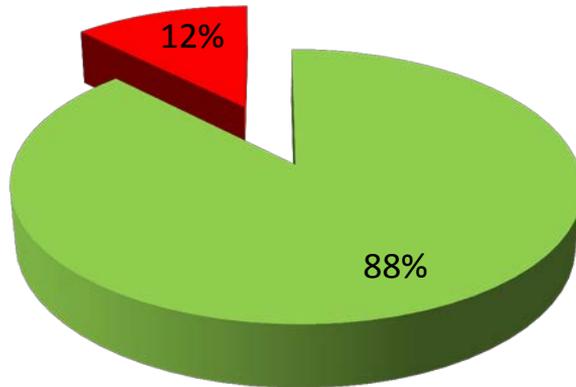
AIDC Message Breakdown (Total 2400)

■ Successful AIDC Messages   ■ Rejected AIDC Messages
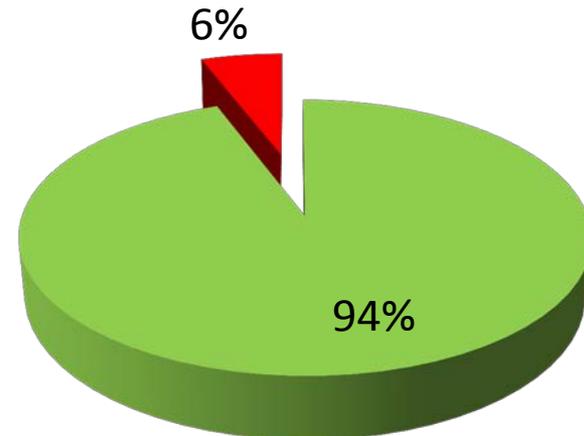
6%

94%

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AIDC Lessons Learned

Breakdown of 53 Detected Errors on Unique Flight Plans – CAATS Inbound from FAA	CZYZ CAATS		KZOB ERAM
FP Not Your Control	122		Occurs when a MOD is received and CAATS has already taken jurisdiction of the aircraft.
Unknown DEPT	1		Departure aerodromes were not in the adaptation data at the time.
Invalid Field 18 Syntax	1		General syntax error
Invalid Route	3		Route/Airway not in adaptation at the time
Unknown/Other	10		Did not know the cause at the time and detailed SW investigation was required.

Breakdown of F/P Errors (137)

■ FP Not Your Control ■ Invalid Route
■ Invalid Field 18 Content ■ Unknown Dept
■ Unknown/Other

Pie chart values: 89%, 7%, 2%, 1%, 1%
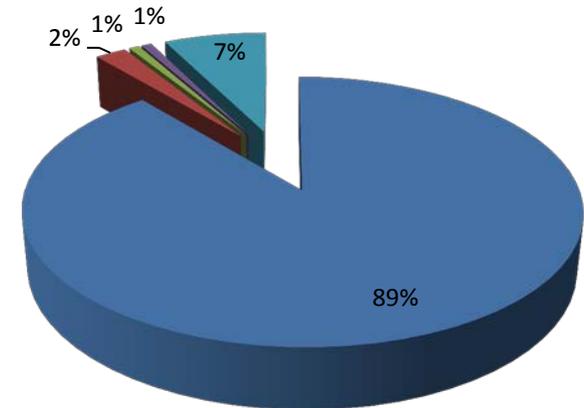
AIDC Lessons Learned – AFTN 2015

AIDC Traffic Stats and AFTN Latency on August 20th, 2015 Toronto FIR (CZYZ)

Less than 1 second in almost every case

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Lessons Learned
Managing the AIDC Interface – Post Implementation

- FIR – FIR Bilateral coordination
  - A must for successful interfaces
  - Identifying differences in system processing
  - Establish technical and procedural rapport with interfaced facilities
- Periodic Issue Discussion – Twice a month
- Issues
  - Adaptation Changes
  - Route/Fix Changes
  - System Changes
  - Procedure Changes
  - Airspace Changes
  - Flight Planning

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- Flight Planning
  - Duplicate FPLs
  - CPLs can replace system (FPL) data

ANSP 1	ANSP 2	ANSP 3
FPL 1 accept	**FPL 1 accept**	**FPL 1 accept**
FPL 2 accept	**FPL 2 reject Dup**	**FPL 2 reject Dup**

CPL from ANSP 1 → CPL accept → CPL accept

FPL 2 Data   **FPL 2 Data**   **FPL 2 Data**

Conclusion

- Standardization of automated data exchange technologies and procedures is critical to cross-border, regional and multi-regional interoperability. This, in turn, drives the seamless operation of global systems. Sharing the issues encountered in implementing system interfaces serves to shorten the time of implementation between member system testing , increase system to system ANSP knowledge and reduce adaptation and software costs.

- Harmonization supports safety objectives through standardization and promotes economic efficiencies. A harmonized system cannot be built without developing partnerships with our Cross Border member states and international counterparts to identify system differences and collaborate on contiguous compatible solutions.

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THANK YOU