



NAV CANADA and DATA LINK IMPLEMENTATION

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NAV CANADA

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SERVING A WORLD IN MOTION

OPDWLG – Operational Data Link Working Group

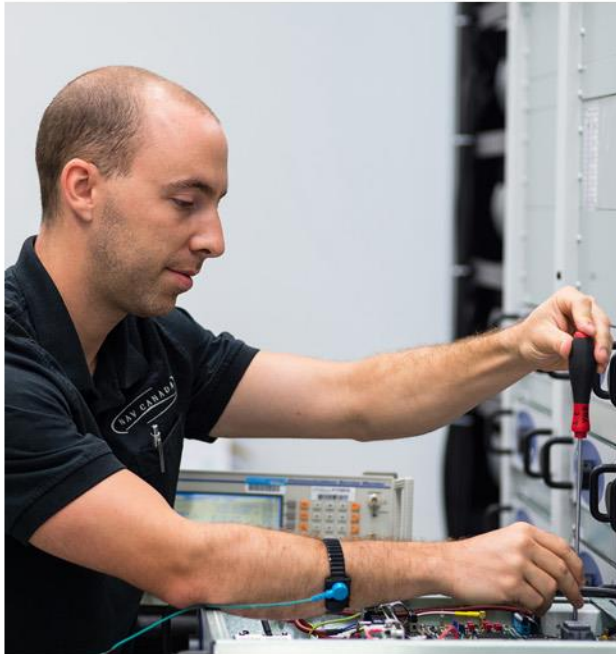
- 5 members here today representing ANSPs, manufacturers and regulators
- Small representation of a multi-disciplinary group made up of such groups as, human factors specialists, regulators, aircraft systems specialists, air carriers, pilots, and controllers.
- Make recommendations on operational datalink to the ANC.

About NAV CANADA



- Private, non-share capital company
- 2nd largest ANSP in the world
- 12 million aircraft movements annually
- 18 million square km of airspace
- Regulated by Federal Government on safety performance

Our People



4,600 employees across the country

- Air Traffic Controllers
- Flight Service Specialists
- Electronics Technologists
- Engineering and IM
- Corporate Functions

Canadian Airspace Characteristics

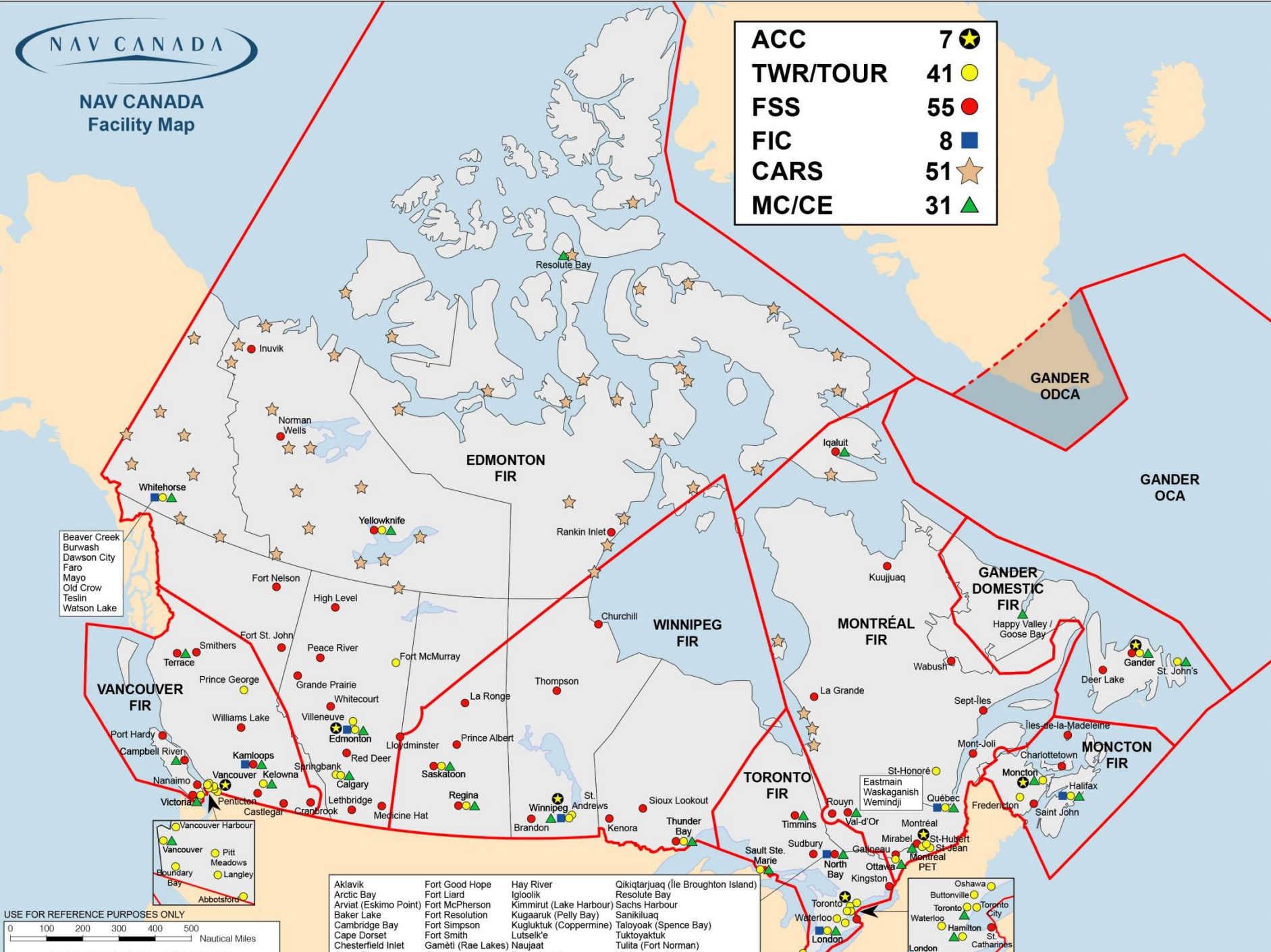


- Vast distances
- Climate varies from polar to temperate
- Crossroads of global air traffic flows
- Busiest oceanic airspace in the world
- Unique northern airspace operations
- Stimulus for innovation



NAV CANADA Facility Map

ACC	7	★
TWR/TOUR	41	●
FSS	55	●
FIC	8	■
CARS	51	★
MC/CE	31	▲



Beaver Creek
Burwash
Dawson City
Faro
Mayo
Old Crow
Teslin
Watson Lake

● Vancouver Harbour
 ▲ Vancouver
 ● Pitt
 ● Meadows
 ● Langley
 ● Abbotsford

Aklavik	Fort Good Hope	Hay River	Qikiqtarjuak (Ile Broughton Island)
Arctic Bay	Fort Liard	Igloolik	Resolute Bay
Arviat (Eskimo Point)	Fort McPherson	Kimminut (Lake Harbour)	Sachs Harbour
Baker Lake	Fort Resolution	Kugaaruk (Pelly Bay)	Sanikiluaq
Cambridge Bay	Fort Simpson	Kugluktuk (Coppermine)	Taloyoak (Spence Bay)
Cape Dorset	Fort Smith	Lutselk'e	Tuktoyaktuk
Chesterfield Inlet	Gameti (Rae Lakes)	Nauyasat	Tulita (Fort Norman)
Clyde River	Gjoa Haven	Pangnirtung	Ulukhaktok (Holman)

USE FOR REFERENCE PURPOSES ONLY

0 100 200 300 400 500 Nautical Miles

— Flight Information Region (FIR) boundaries

● Oshawa
 ● Buttonville
 ● Toronto
 ● Toronto City
 ● Waterloo
 ● Hamilton
 ● St. John's
 ● St. Catharines

System Progress



Investment

\$2 billion in new technology and facilities since 1996.

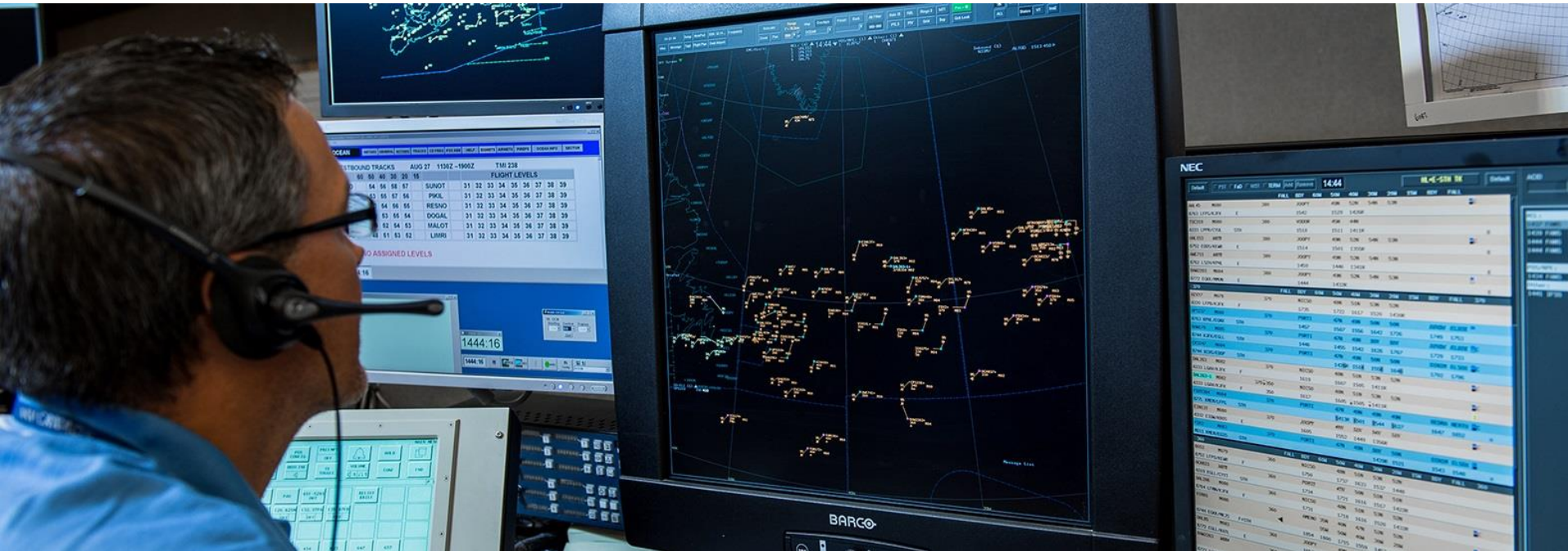
DATA LINK IN CANADA

- OCEANIC SERVICES
- DOMESTIC SERVICE
- TOWERS

Gander Oceanic

- Controls between 1400-1600 transatlantic flights per day
- Two primary traffic flows
 - Eastbound – catches the winds of the Jetstream
 - Westbound – avoid the Jetstream winds
- First data link services to a FANS1/A aircraft was in 2001
- Introduced the NAT Data Link Mandate in 2013
- Now using 3 data link based separation standards.

Gander Automated Air Traffic System (GAATS)+



- Advanced oceanic ATC system in Gander and in Prestwick, UK
- Automates flight data processing, integrates ADS position reports and CPDLC communications
- Faster response to customer requests
- Supports reduced oceanic separation
- Now integrated with Oceanic ADS-B

NAT Data Link Mandate

- The objectives of the NAT DLM are to enhance communication, surveillance and air traffic control (ATC) intervention capabilities in the NAT region, in order to reduce collision risk and enable the NAT target level of safety to be met, particularly in the vertical plane.
- Objectives are that by 2018, 90% of aircraft operating in the NAT region airspace at FL 290 and above will be equipped with Future Air Navigation Systems 1/A (FANS 1/A) (or equivalent) ADS-C and CPDLC systems and that by 2020, 95% of aircraft operating in that airspace, will be so equipped.

NAT Data Link Mandate

Phase 1

- Commenced February 2013: FL 360 to FL 390 (inclusive)_all aircraft operating on two specified core tracks within the NAT OTS

Phase 2A

- Commenced 5 February 2015: FL 350 to FL 390 (inclusive) all tracks within the NAT OTS.;

Phase 2B

- Commencing 7 December 2017: FL 350 to FL 390 (inclusive) throughout the ICAO NAT region;

Phase 2C,

- Commencing 30 January 2020: FL 290 and above throughout the ICAO NAT region.

NAT DLM Requirements



The following flights are permitted to flight plan to enter the NAT DLM airspace:

1. Flights equipped with and prepared to operate FANS 1/A (or equivalent) CPDLC and ADS-C data link systems. (J2/J5/J7 and D1)
2. Non-equipped flights that file STS/FFR, HOSP, HUM, MEDEVAC SAR, or STATE in Item 18 of the flight plan. (Depending on the tactical situation at the time of flight, however, such flights may not receive an ATC clearance which fully corresponds to the requested flight profile).

NAT Equipage since DLM started

	Total Flights	% Using ADS-C	% Filing ADS-C	% Using CPDLC	% Filing CPDLC
December 2013	27,573	78%	80%	77%	80%
December 2015	30,607	84%	90%	83%	90%
Percent Change	11%	8%	13%	8%	13%

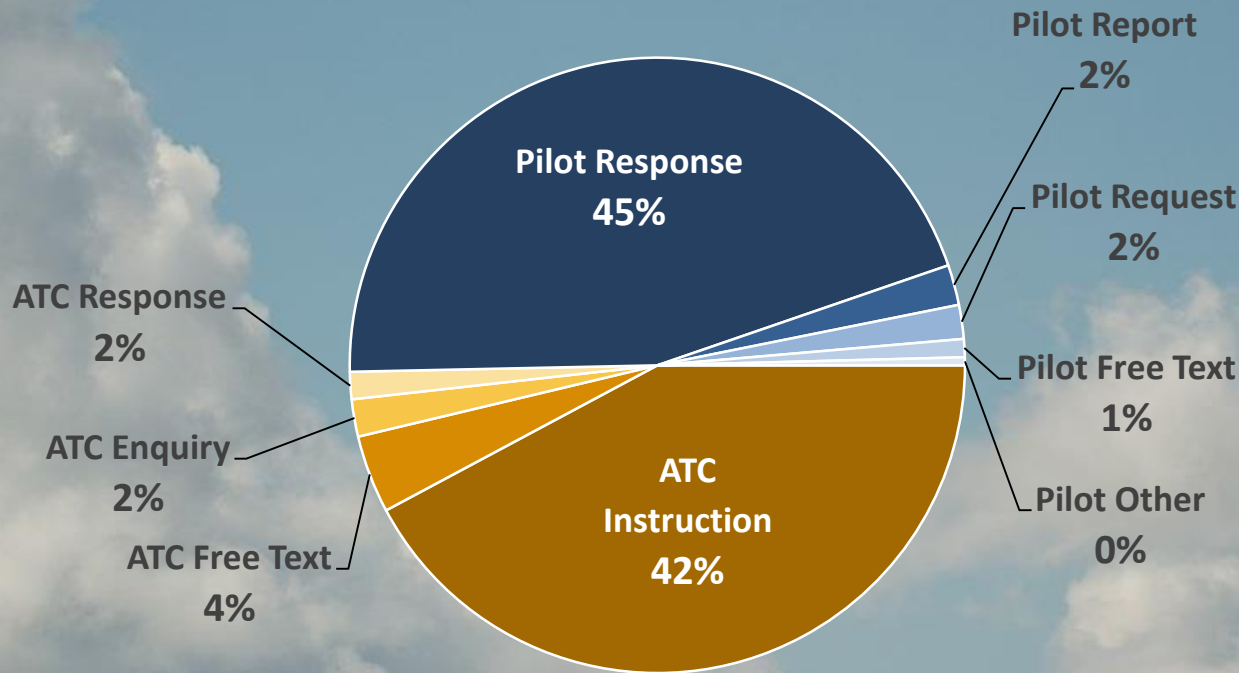
Data Link IN DOMESTIC AIRSPACE



- Started December 15th, 2011 with one Area Control Center (ACC)
- Increased by one ACC at a time until we successfully implemented CPDLC in all 7 ACCs
- Phased in message set.
- ADS-C in 1 ACC with plans to implement in the other 6

Controller-Pilot Data Link Communications

CPDLC Messages | Domestic



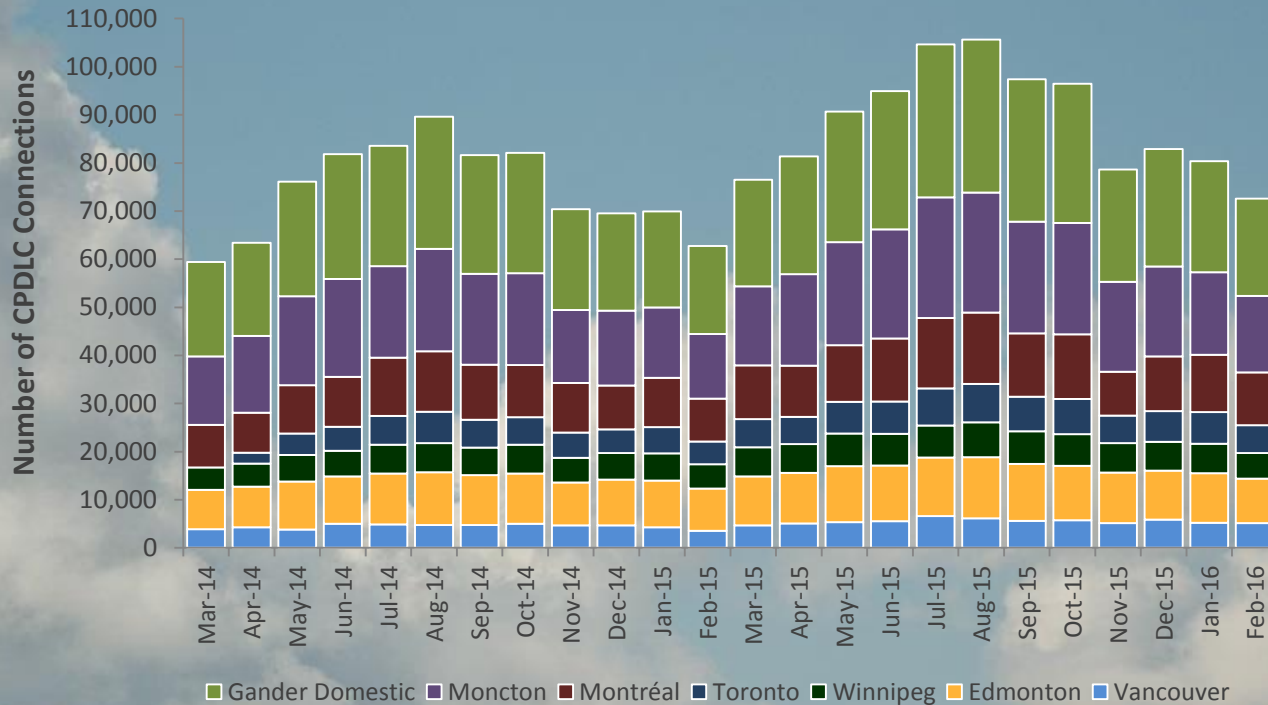
556,000
DOMESTIC MESSAGES
in FEBRUARY 2016
Includes **258,000**
Automated and System
Messages

16%
Over
FEBRUARY 2015

Fully functional in all domestic flight information regions above flight level 290

Domestic CPDLC Connections by FIR

Domestic CPDLC Connections March 2014 – February 2016



NUMBER OF CPDLC CONNECTIONS

1,062,244

March 2015 to February 2016

890,318

March 2014 to February 2015

19%

For 12 months ending Feb 2016 over previous year

Data Link IN TOWERS AND IFSS



- PDC - Pre-Departure Clearance (ARINC 620) – 12 Towers
- Voiceless PDC (ARINC 623) – Winnipeg, Montreal, Toronto City Centre
- ATIS (ARINC 620) – 25 Towers



So....how did we get there?

- Planning – develop a concept of operations
- Promoting and encouraging services and equipage - DLM
- Using a phased approach
- Coordinating with users and adjacent units
- Setting realistic time lines/target dates for system changes



Project Planning

Developing a Concept of Operations



Consider what services you want to implement.

▣ CPLDC

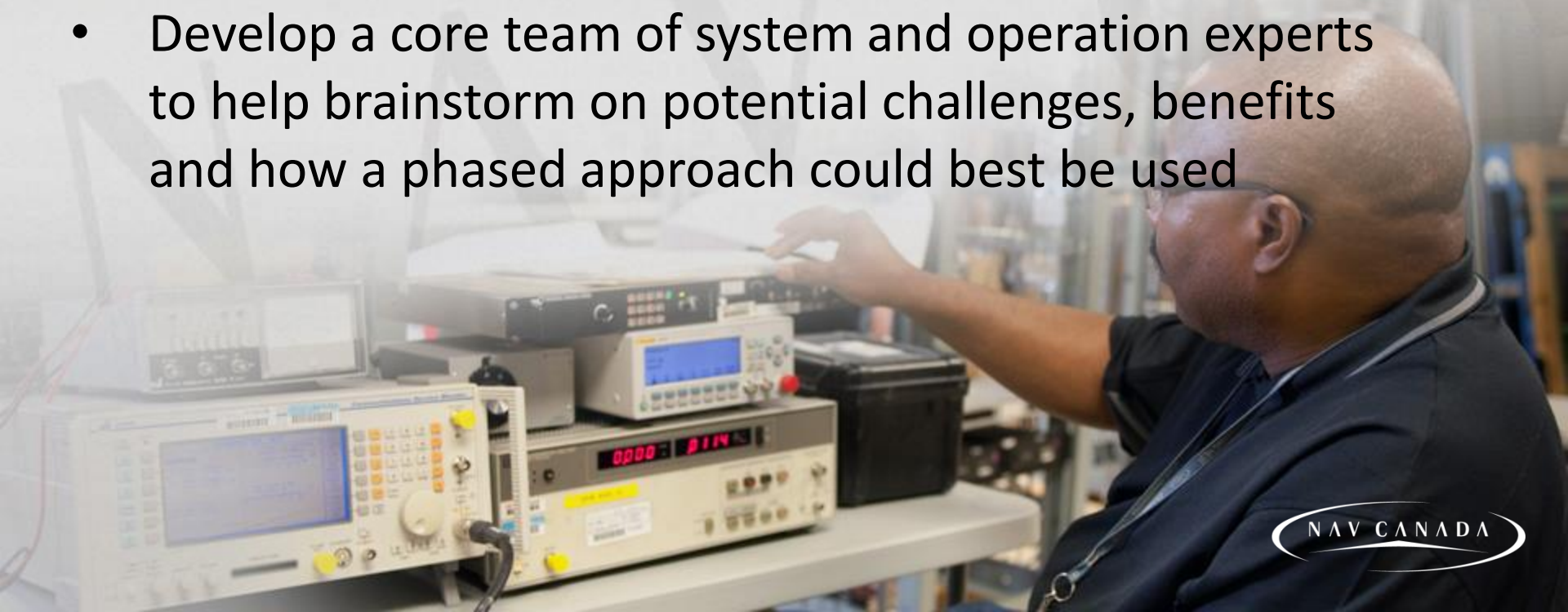
- Where will CPDLC be used (i.e. what airspace within the FIR will CPDLC be used in?)
- Will CPDLC be used for primary communications, or as a backup to HF (or VHF)?

▣ ADS-C

- What contracts will be set up?
- In which airspace
- Will these services replace existing services

Developing a Concept of Operations

- Refer to GOLD chapter 1 which provides guidance on preparing for the initial operational implementation of CPDLC and ADS-C
- Develop a core team of system and operation experts to help brainstorm on potential challenges, benefits and how a phased approach could best be used



CPDLC PLANNING

CPDLC

- significantly enhances air/ground communication capability and therefore controller intervention capability.

What services will CPDLC be used for?

- Vertical clearances?
- Route clearances?
- Weather deviations?
- Issuing SSR codes?
- Frequency transfers?
- Everything?
- Is all traffic in VHF coverage?

ADS-C PLANNING

ADS-C

- provides capabilities for conformance monitoring of aircraft adherence to cleared route and FL, thereby significantly enhancing safety in the NAT region. ADS-C also facilitates search and rescue operations and the capability to locate the site of an accident in oceanic airspace.

What services will ADS-C be used for?

- Situational awareness?
- Reducing existing separations?
- Conformance monitoring?
- Replacement for voice position reporting?

Changes to Separation Standards

Will any separation standards will be supported by ADS-C and CPDLC?

- ▣ 10 minutes?
- ▣ 5 minutes longitudinal?
- ▣ 30NM?
- ▣ 23NM?
- ▣ Establishing lateral separation?

Develop Procedures

- For flight crews and controllers
- GLOBAL applicability and standardization is critical
- GOLD – The Global Operational data link Manual (DOC 10037) provides excellent guidance material for all users

Develop Procedures - Crews

Define logon procedures – these will be affected by:

- ▣ where FANS will be used
- ▣ adjacent units using CPDLC or ADS-C
- ▣ local requirements. Airlines will expect these to be in accordance with existing procedures in other regions

Refer to Chapter 4 in GOLD – crew procedures

Develop Procedures - Controllers

- LOGON failure – how to troubleshoot and assist crews
- When to use CPDLC and when to use voice
- Dealing with transfers to other units (failures)
- How to respond to ADS-C events
- How to respond to system failures
- Create controller “cheat sheets”

Refer to Chapter 3 in GOLD – controller and radio operator procedures

SYSTEM PREPARATION

- Develop system requirements – engineers / contractor and controllers
- What will be automated versus manual intervention - HMI
- Determine preferred data link service provider and negotiate contract
- Guidance can be found in Chapters 1 and 2 of GOLD



System Considerations

- ▣ Are CPDLC Connections to be established automatically or manually?
 - Manual ==> ATC controls who uses CPDLC and when
 - Automatic ==> reduced ATC workload, but also means it is more difficult to control when CPDLC is used by flight crew

- ▣ Will data link transfers be effected to adjoining units?
 - Yes ==> Need to define addresses of surrounding ATS units

- ▣ Will data link transfers be a manual or automatic process?
 - Manual ==> Controller training/scanning issue
 - Automatic ==> Data needs to be defined (NDA & Address Forwarding)

- ▣ Will CPDLC termination be automatic or manual?
 - Manual ==> Controller training/scanning issue
 - Automatic ==> Data needs to be defined (Auto EOS).

System Adaptation

System Adaptation – based on CONOPS and LOAs

- ▣ Addresses – yours and adjacent units
- ▣ Timers for connections, transfers and ending services

Controller’s CPDLC interface – define the layout (the capability to do this will vary depending on the ATM system):

- ▣ Message categories
- ▣ Message elements within each message category. Will the entire CPDLC message set be available?
- ▣ Determine required pre-formatted free text message elements

ADS-C – what contracts will you use?

- ▣ Define ADS-C periodic reporting rates – ensure that they are “reasonable” (i.e. not excessive), and are appropriate for the services being applied;
- ▣ Define parameters for ADS-C event contracts

CPDLC Message Editor - ACA001

Open Downlink Dialogues
ID Time Text

UNABLE ROGER AFFIRM NEGATIVE REQUEST DEFERRED

Common / Emergency / Confirm / Coms/Bdy / Route / Climb / Descend / Misc

Uplink Message Element List

NEXT DATA AUTHORITY (facility designation)
END SERVICE
(free text)

Uplink Messages

Text
NEXT DATA AUTHORITY [EGGX]

ADS Contracts - ACA111

<p style="text-align: center;">Periodic</p> <p><input type="radio"/> Met Contract</p> <p><input type="radio"/> Emergency</p> <p><input checked="" type="radio"/> RLongSM (18 Minutes)</p> <p><input type="radio"/> Not Used</p> <p><input type="radio"/> Not Used</p> <p><input type="radio"/> Not Used</p> <p><input type="radio"/> None</p>	<p style="text-align: center;">Events</p> <p><input checked="" type="checkbox"/> Level Deviation <i>ceiling</i> FL <input type="text" value="343"/></p> <p><input checked="" type="checkbox"/> Lateral Deviation <i>Floor</i> FL <input type="text" value="337"/></p> <p><input checked="" type="checkbox"/> Vertical Rate <input type="text" value="5"/> nm</p> <p><input type="checkbox"/> Vertical Rate <input type="text" value=""/> x64 ft/min</p>
<p><input type="checkbox"/> Emergency Mode</p> <p>Cancel Emergency Mode <input type="button" value="OK"/></p>	<p><input checked="" type="checkbox"/> Waypoint Event</p> <p><input type="button" value="Demand Contract"/></p> <p><input type="button" value="Cancel All Contracts"/></p>
<input type="button" value="Close"/>	<input type="button" value="Initiate CPDLC"/> <input type="button" value="Issue"/>

Coordination

Airlines

- ▣ To assist in a smooth transition to data link operations, the major data link operators throughout the region should be contacted directly
- ▣ Are LOAs currently held with airlines? If so, do they need to be updated?
- ▣ Determine appropriate points of contact with airlines to rapidly address data link related problems with flight crews (safety@airlines.com)

Coordination

Adjoining data link capable ATSU's

- ▣ Are data link transfers from adjoining units for inbound aircraft required?

- ▣ LOAs may need to be updated

- ▣ Determine appropriate points of contact with adjoining units to rapidly resolve data link transfer problems

Coordination

Regulator

- ▣ Is liaison with, or approval from, the regulator required?
- ▣ Is regulator approval required for other State aircraft to operate data link in the airspace?

Coordination

HF operators

- ▣ Need to be aware of how the implementation of data link will affect them;
- ▣ Are SELCAL checks still required?
- ▣ Will controllers issue CPDLC frequency transfers.
- ▣ HF frequency, do controllers have access to up to date HF frequencies?

Documentation

Publish data link information in AIP, including:

- ▣ logon codes;
- ▣ logon procedures;
- ▣ required flight crew procedures
- ▣ standardised free text message elements in use;
- ▣ position reporting procedures;
- ▣ any specific CPDLC message elements not supported?
- ▣ ATC procedures

Controller licencing and training

- ▣ Relevant aspects of ADS-C and CPDLC must be covered in controller training
- ▣ Is data link required to be included in the existing controller licence, or an addition to it?
- ▣ Update any controller written assessment questions to include data link related questions
- ▣ Update controller qualification procedures to include data link during the assessment

Initial Operational Implementation of CPDLC and ADS-C

Prior to operational implementation, the ANSP should confirm that their equipment and procedures meet system integrity requirements. This process should include:

- a system safety assessment which demonstrates that the service provision meets the safety objectives.
- These assessments should include:
 - identifying failure conditions;
 - assigning levels of criticality;
 - determining probabilities for occurrence; and
 - identifying mitigating measures.

❑ Conduct integration testing and operational trials confirming interoperability for operational use of the aircraft and ground systems; and

❑ Confirm that the ATS operation manuals are compatible with those of adjacent providers

Safety Monitoring

- Ensure that a means of reporting data link related occurrences is available,
- Ensure staff are trained to investigate data link related occurrences
- More in another session.





QUESTIONS?



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