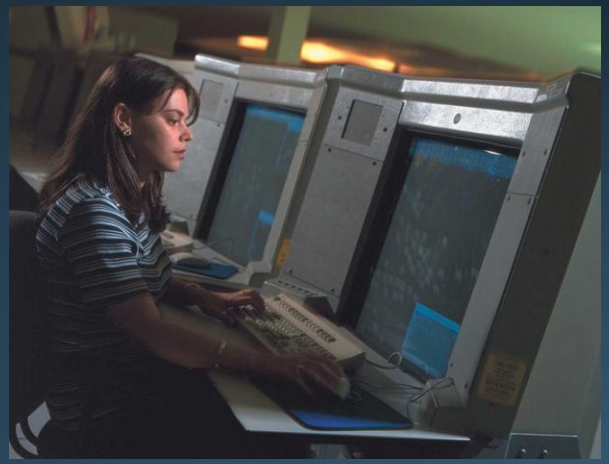
Configuration Management Overview



Larry James

Director

Air Traffic Management Engineering

Marc Charron

Manager

Oceanic ATC Systems

Scope of Presentation

- Configuration Management
  - Broad subject, changes occur everywhere
- Key areas addressed in this presentation
  - People and Organization
  - Planning, Acquisitions & Prioritization
  - Maintenance Management
  - Engineering Management
  - Configuration Management
  - Future Opportunities

People and Organization

Initial Challenges

Initial state of operational systems was deficient:

- ineffective investment dominated by major programs
- led to high cost of development and training
- normal “run-of-the-mill” replacements were ignored
- equipment down time led to reduced service levels
- lack of responsiveness led to regional solutions
- multiplicity of regions led to inconsistent configurations
- testing Environment no longer reflected operational configuration
- significant challenges fielding national systems
- incomplete knowledge of what was fielded
- obvious opportunities for changes and improvements

Organizational Changes

- Consolidate system development to one single location
  - Head Office focuses on development /acquisition and approving Field Modification instructions
  - Regional engineering resources focus on implementation
  - Technical Operations focus on preventative & corrective maintenance, implementing approved field-modifications
  - Operations focuses on ATC operations, requirements, procedures and training
- Demographics of HO group
  - Skill set of new hires aligned to latest needs (software development)
  - More in-house development for software intensive ATM projects
- Small multi-discipline development teams
  - software, logistic support, end-users (including ATC)

People and Organization Changes

- Shorter project timeframes
  - size project to definable pieces of functionality
  - adopt a “time to market” mindset
  - responsive lifecycle management for each system
- Manage the “Wants Versus Needs”
- Outcome:
  - System configuration management improvements
  - Proactive to required changes
  - Quicker delivery of product to operations
  - Backlog of technology for implementation
  - Significant infrastructure has been replaced

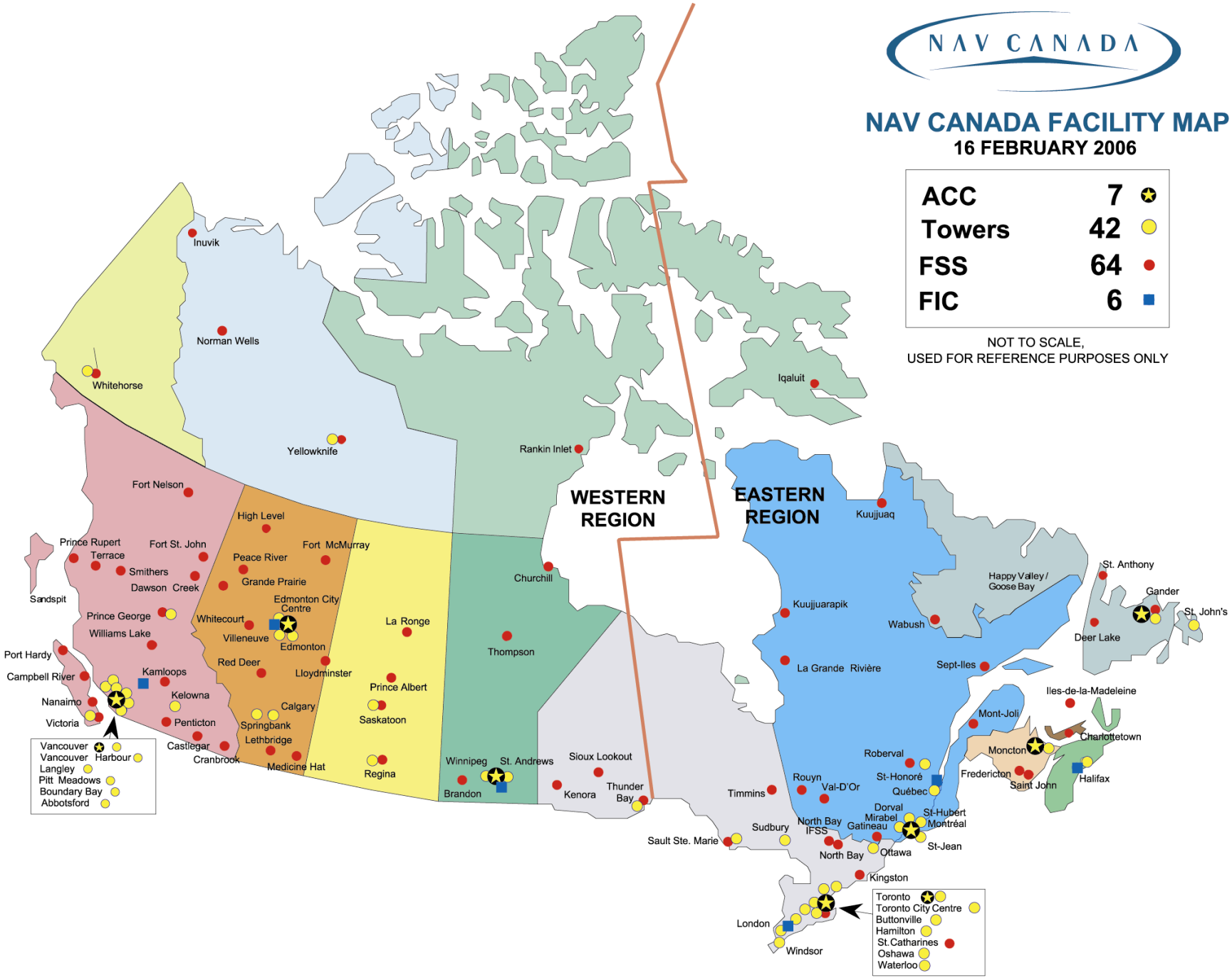
Engineering
By the Numbers

- 470 employees
  - ~300 in HO
- 122 supported systems
  - Hardware platforms
  - Software languages and o/s
- Over 15 million LOC (application)
- 100 major S/W releases per year
- Numerous major H/W field mods/year
- Typically 75 to 100 capital projects per year

Challenges NAV CANADA Assets

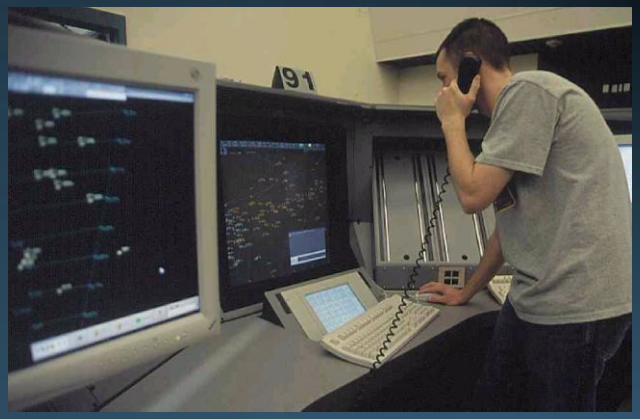
NAV CANADA owns, operates & maintains:

- 7 Area Control Centers;
- 42 Control Towers;
- 64 + 6 (new) = 70 Flight Service Stations;
- 6 Flight Information Centers;
- 51 Community Airport Radio Stations;
- 41 Maintenance Centres;
- 1400 ground-based Navaids;
- 200 plus Voice & Control Switches;
- 45 radars
- 300 sites with weather related equipment


NAV CANADA
NAV CANADA FACILITY MAP
16 FEBRUARY 2006
ACC 7
Towers 42
FSS 64
FIC 6
NOT TO SCALE,
USED FOR REFERENCE PURPOSES ONLY
WESTERN REGION
EASTERN REGION
Inuvik
Norman Wells
Whitehorse
Yellowknife
Iqaluit
Rankin Inlet
Fort Nelson
High Level
Prince Rupert
Terrace
Fort St. John
Fort McMurray
Peace River
Smithers
Grande Prairie
Dawson Creek
Sandspit
Edmonton City Centre
Prince George
Whitecourt
La Ronge
Williams Lake
Villeneuve
Edmonton
Port Hardy
Red Deer
Thompson
Campbell River
Kamloops
Lloydminster
Nanaimo
Kelowna
Prince Albert
Calgary
Victoria
Penticton
Saskatoon
Springbank
Castlegar
Lethbridge
Cranbrook
Medicine Hat
Regina
Churchill
Winnipeg
St. Andrews
Brandon
Sioux Lookout
Kenora
Thunder Bay
Timmins
Sudbury
Sault Ste. Marie
North Bay
Kingston
Ottawa
Kuujjuaq
Kuujjuarapik
Wabush
La Grande Rivière
Happy Valley / Goose Bay
St. Anthony
Gander
St. John's
Deer Lake
Sept-Iles
Iles-de-la-Madeleine
Mont-Joli
Roberval
Rouyn
Val-D'Or
St-Honoré
Québec
Dorval
Mirabel
Gatineau
St-Hubert
Montréal
St-Jean
Moncton
Charlottetown
Fredericton
Saint John
Halifax
London
Windsor
Vancouver
Vancouver Harbour
Langley
Pitt Meadows
Boundary Bay
Abbotsford
Toronto
Toronto City Centre
Buttonville
Hamilton
St.Catharines
Oshawa
Waterloo

Engineering Program
ATM/Training/Infrastructure

- **ATM**
  - Radar Data Processing
  - Flight Data Processing
  - Controller Workstations
  - ATC Decision Support Tools
  - Weather Systems
  - Pilot Information Kiosk (WX self-briefing)
  - WX systems
- **Training**
  - 360° Tower Simulators - Training
  - Radar Simulators/Pseudo Pilots - Training
- **Simulation**
  - Airspace Simulators
  - S/W Evaluations
- **Responsibility within one organization**
  - Operational system and all infrastructure

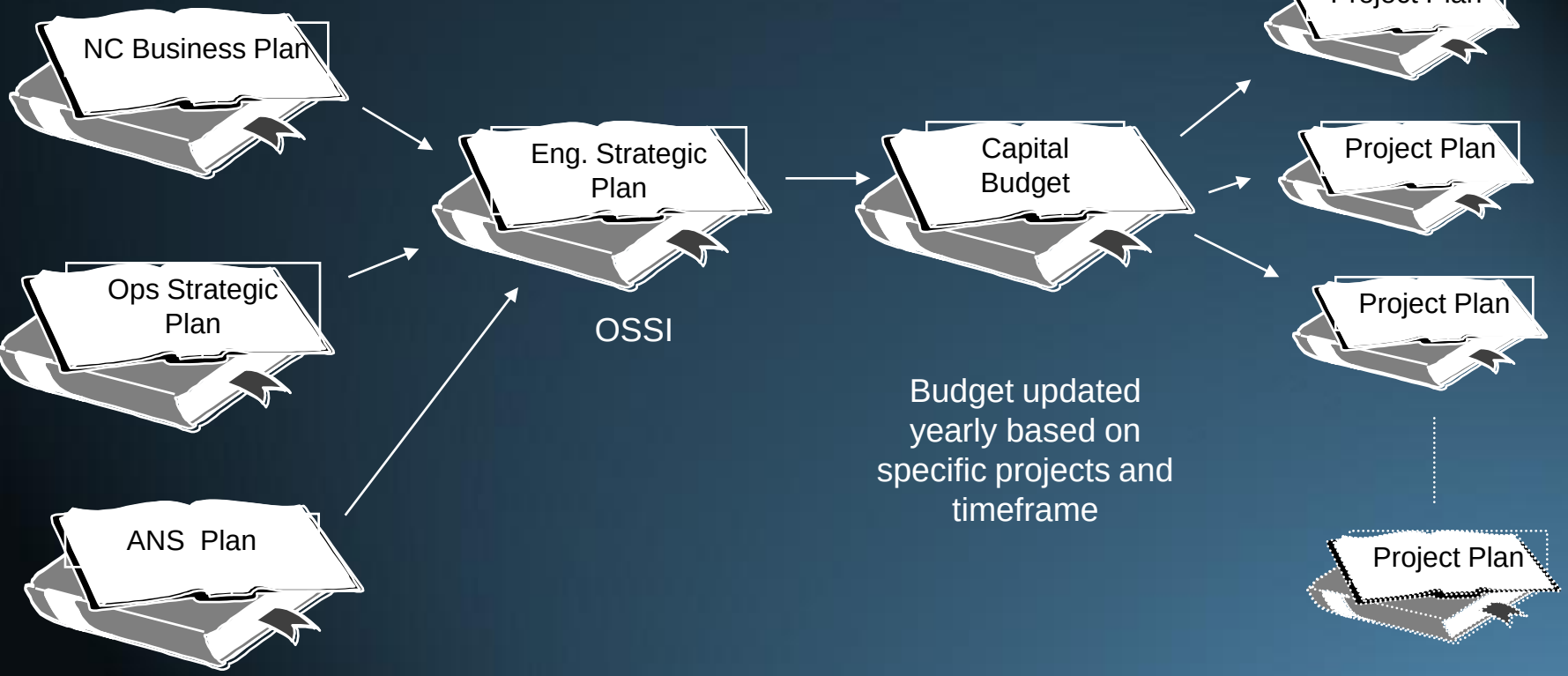


Regional Engineering

- Planning, installation, testing and commissioning of operational systems in the field
  - CARS mandates competency program for implementation personnel
  - Represents the front (site selection) and end (installation, testing, & commissioning) for Engineering
- Provision of services includes
  - Land use reviews on proposals for Airport Authorities
  - Antenna Clearance forms Review
  - EMI support for on all ANS facilities
  - Second line life cycle support for field systems (first is Tech Ops)
- Telecommunications Services
- Outside Plant Service
- Technical Data Centers

Planning, Acquisitions & Prioritization

Corporate Planning



Project commitments based on PARB/CAPEX approvals

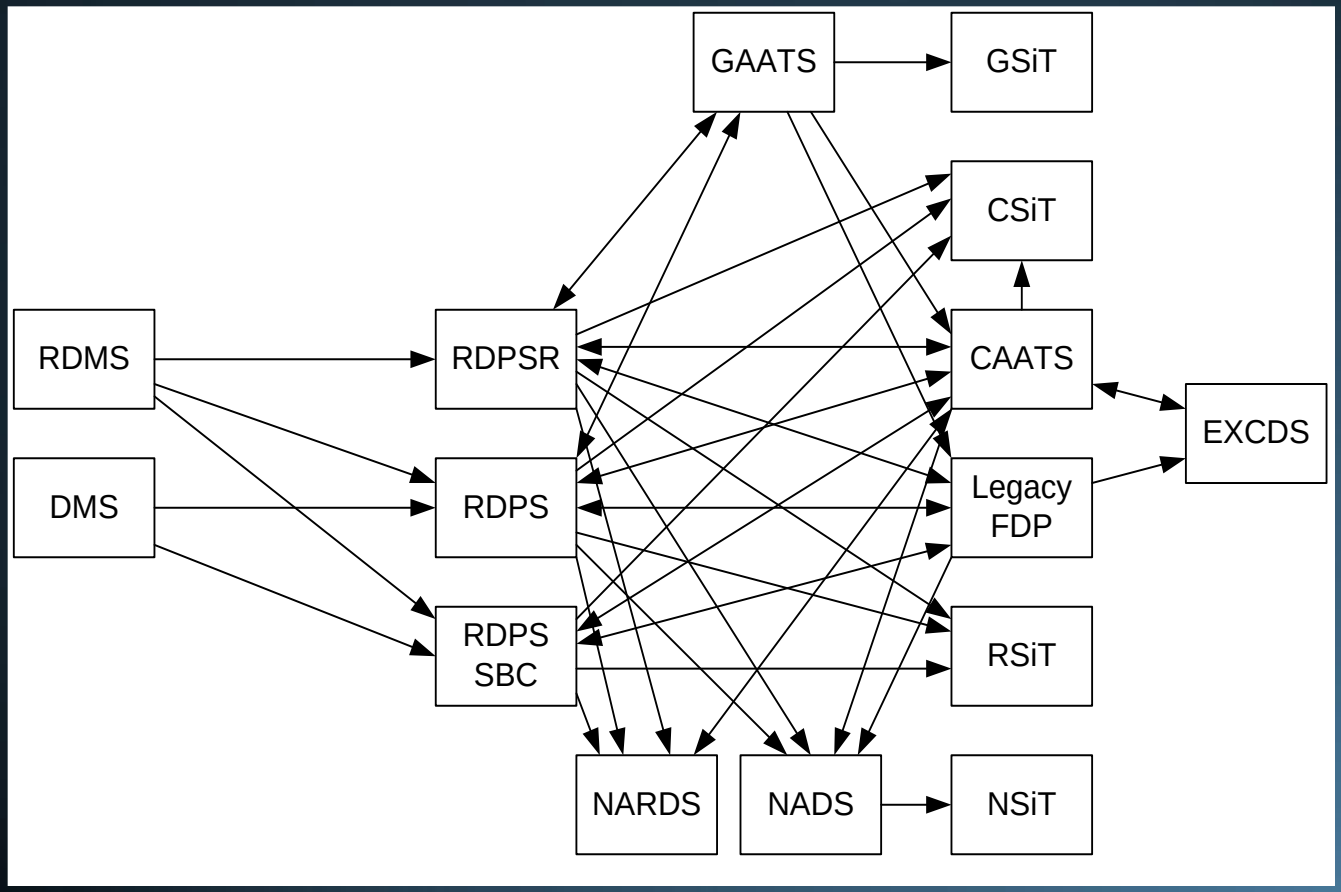
Acquisition Approach

- Use COTS where practical - primarily CNS
- Custom solution if no COTS – primarily ATM
  - Test marketplace
  - Make buy / build decision
  - Multi-disciplinary teams
  - Develop in increments
  - Reduce number of systems types
  - Established Safety Management System, Configuration Management Process, and Life Cycle Management support services
  - Leverage on experienced in-house staff

System Consolidations

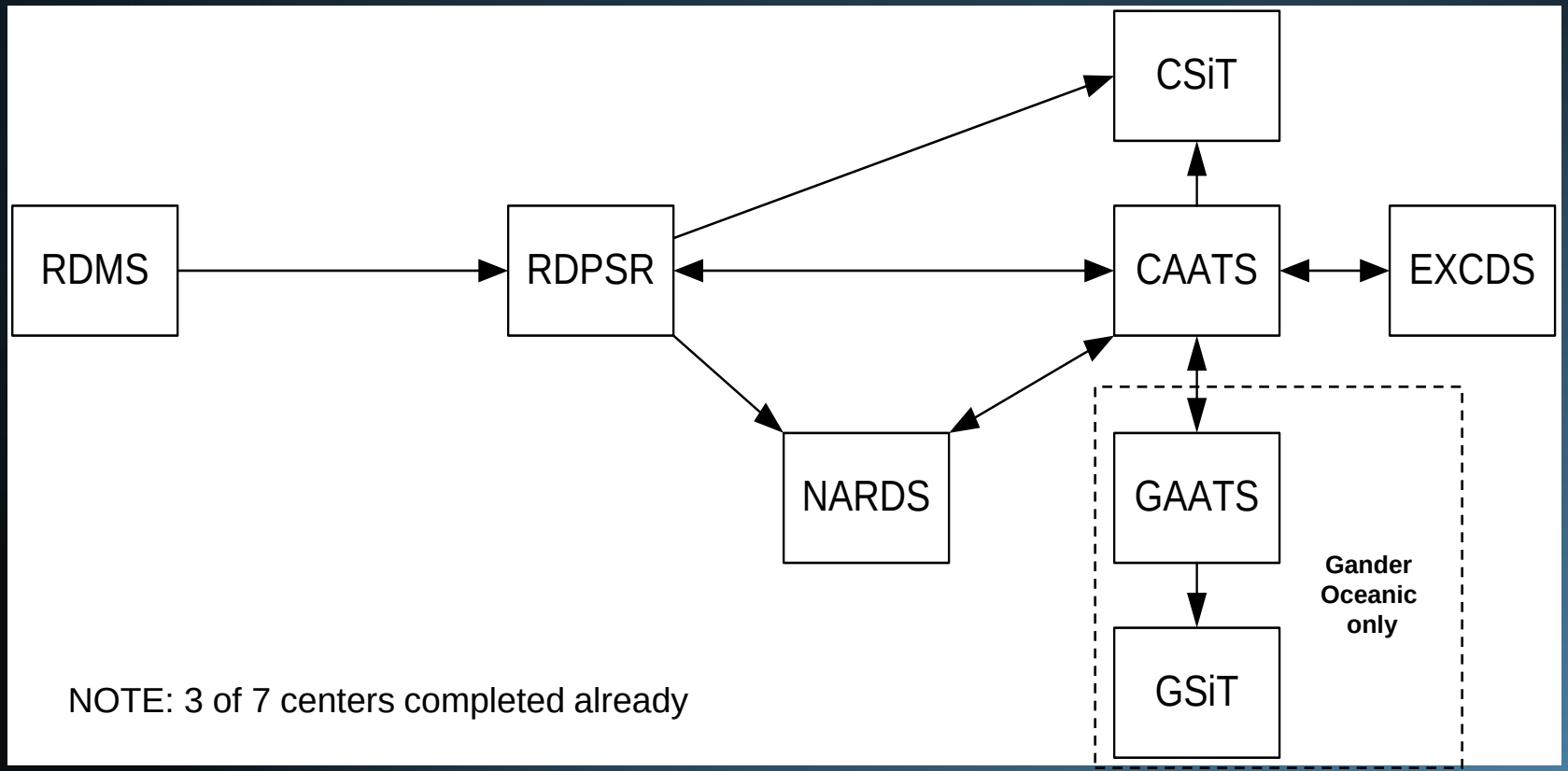
- Consolidated the number of systems in operation
- Y2K created opportunity to reduce # orphan systems
- Standardization of selected system suites
- Bulk Procurement Decisions
- Operating System Standardization
  - HPUX, Windows, Linux
- Outcome:
  - reduced system diversity
  - less Configuration Management challenges

ATM System Interdependencies



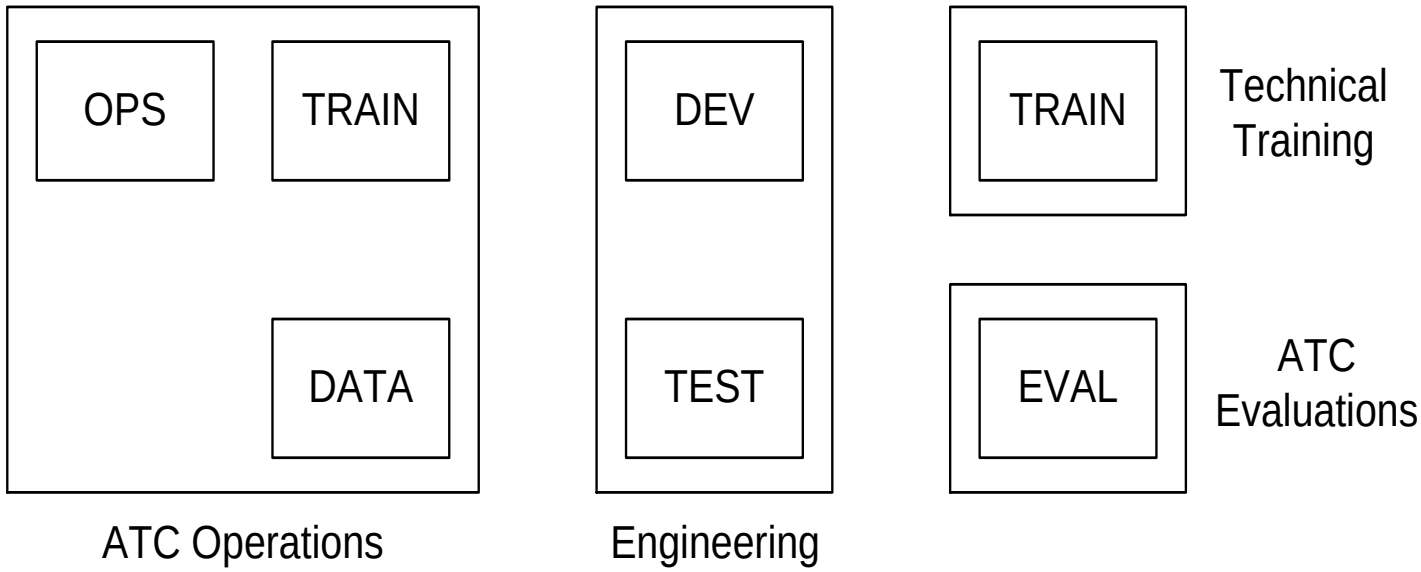
Transitional State

ATM System Interdependencies



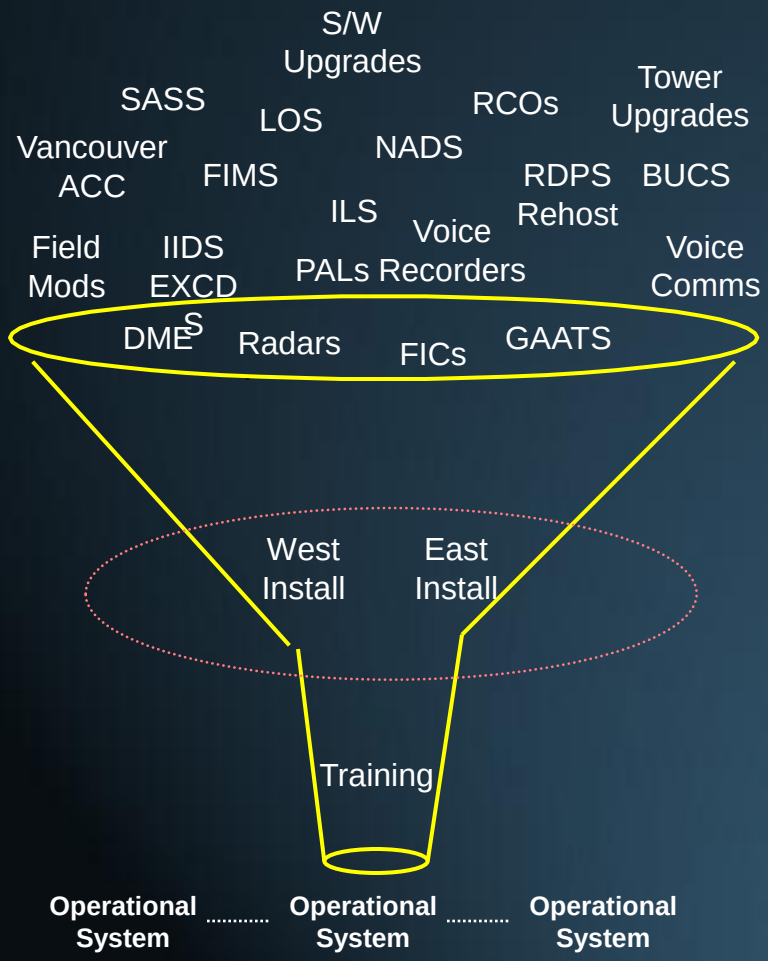
End-State

ATM System Installations



A single ATM system configuration typically ends-up being replicated at multiple sites

New System Development

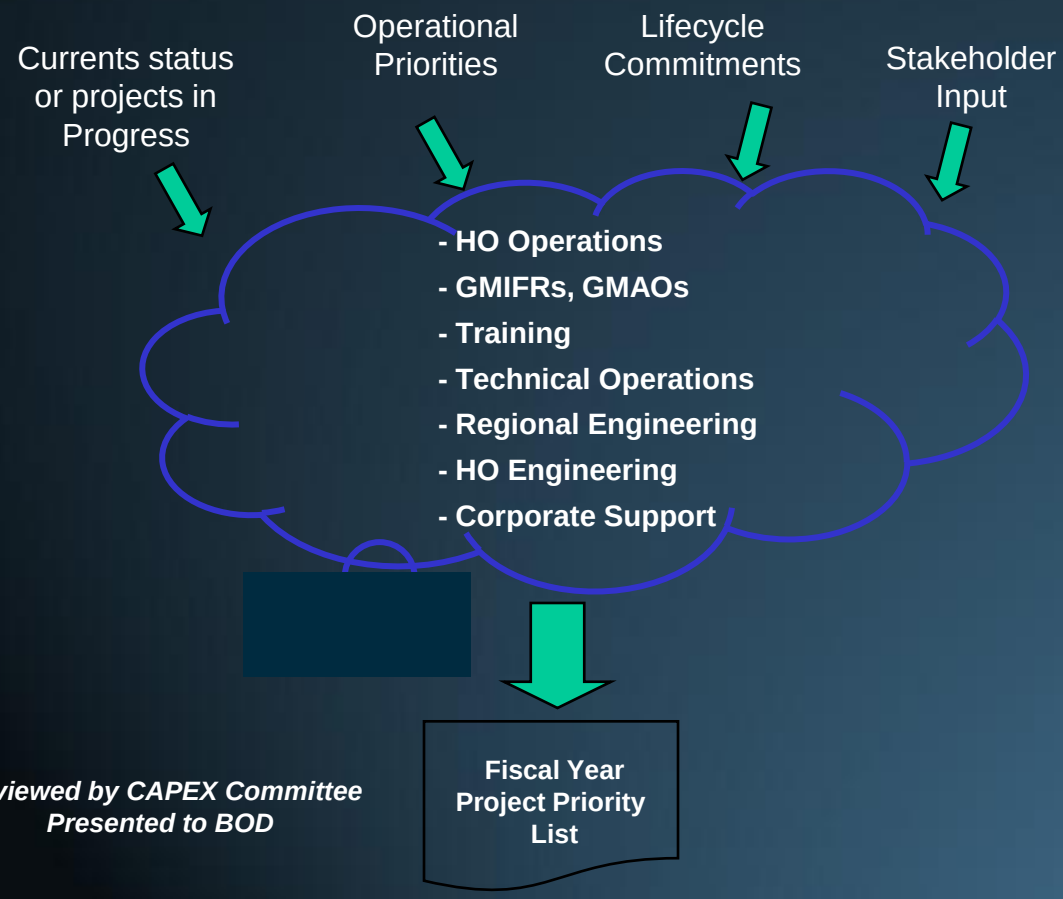


Greatest limitations are related to *installation and training resources*

Required a *Priority Planning Process* to address the multiple workload and organizational bottle necks

Substantial backlog of functional capabilities ready to be fielded

Priority Planning Process



Reviewed by CAPEX Committee
Presented to BOD

Meetings held twice/year

- Feb. before budget cycle
- Sept. confirm dates for major tasks

Decision Factors

- Resource Availability
- Training Capacity
- Project Interdependencies
- Configuration Impacts

Maintenance Management

Maintenance Standards & Procedures

- Standards and Procedures (S&P)
  - Documents baseline configuration changes between Engineering and Technical Operation (Maintenance)
  - Engineering life cycle manages S&Ps
- Field Modifications – Specific S&P
  - Implementation date guidance to Technical Operations
  - S/W implementation verification – First sites
- Engineering / EL Competency
  - Training – System Proof of Performance
  - Ensures staff are capable and trained on installation
- S/W Release Packages
  - System and software version compatibility statements
- Waivers required on any changes to configuration baseline
  - Expiry date, LCM Management approval, tracked

Data & Work Order Management

- Technical Data Documentation Centre
  - Technical Data Management System
  - Baseline system drawings and drawing changes
  - Coordination between HO/Regions/Sites

- MAXIMO - Maintenance Management System
  - Work order concept
  - All Software releases subject of Field Modifications
  - All Field Modifications results in MAXIMO work orders
    - Provide ability to determine S/W implementation status for all systems at all sites

TECHNICAL OPERATIONS

Quality and Safety Program:
To ensure the integrity of the processes used to maintain the Air Navigation System

Elements

- ISO 9001:2000 Service
  - Internal and external audits
- ISO 14001:2004 Environmental
- TechOps Safety Management System

Performance Measurement tool

Maintenance Management System (MMS)

- Maximo computerized reporting system
  - parent / child, workorder generated system,
  - real time reporting,
  - single oracle centralized database,
  - available to any NC employee, NCI (Web) base,
  - routine and special performance reports available

TECHNICAL OPERATIONS

- Work Order based Maintenance Management System
  - Keeps track of maintenance
  - PM Scheduling
  - Times
  - Travel
  - Parts Used
  - Keeps track of configuration (Hardware & Software)
  - Keeps track of Certification
  - Reports (Canned & Discoverer)
  - Off-line application (Akwire)
  - Configuration Template Utility (CTU)
  - Web page

Certification Due Canned Report

Lead Craft/ CM Principal	WO/ BT	Equip. No./ No. Équip.	Location/ Emplacement	WO / BT Description/	Job Plan/ Gamme d'opération	Targ. Start/ Début plan.	Cert Timeout Date/ Date d'échéance	Status/ Statut
TECH-ZQX								
	ZQX-763118		RSITWS01-RDPS-ZQX	PM for Location: RSITWS01-RDPS-ZQX	5-6SIT-12-W	2005/10/19 07:01	2005-10-30	WSCH
	ZQX-763122		RSITWS03-RDPS-ZQX	PM for Location: RSITWS03-RDPS-ZQX	5-6SIT-12-W	2005/10/19 07:01	2005-11-15	WSCH
	ZQX-763133		RSITWS12-RDPS-ZQX	PM for Location: RSITWS12-RDPS-ZQX	5-6SIT-12-W	2005/10/19 07:01	2005-11-22	WSCH
	ZQX-763134		RSITWS13-RDPS-ZQX	PM for Location: RSITWS13-RDPS-ZQX	5-6SIT-12-Q	2005/10/19 07:01	2005-10-22	WSCH
	ZQX-763143		TESS-RDPS-ZQX	PM for Location: TESS-RDPS-ZQX	5-11RDPS-12-A	2005/10/19 07:00	N/A	WSCH

- [d:\Max411\Reports\WOCERTSM.RPT]

5 of 7 | 100% | Total:73 | 100% | 73 of 73

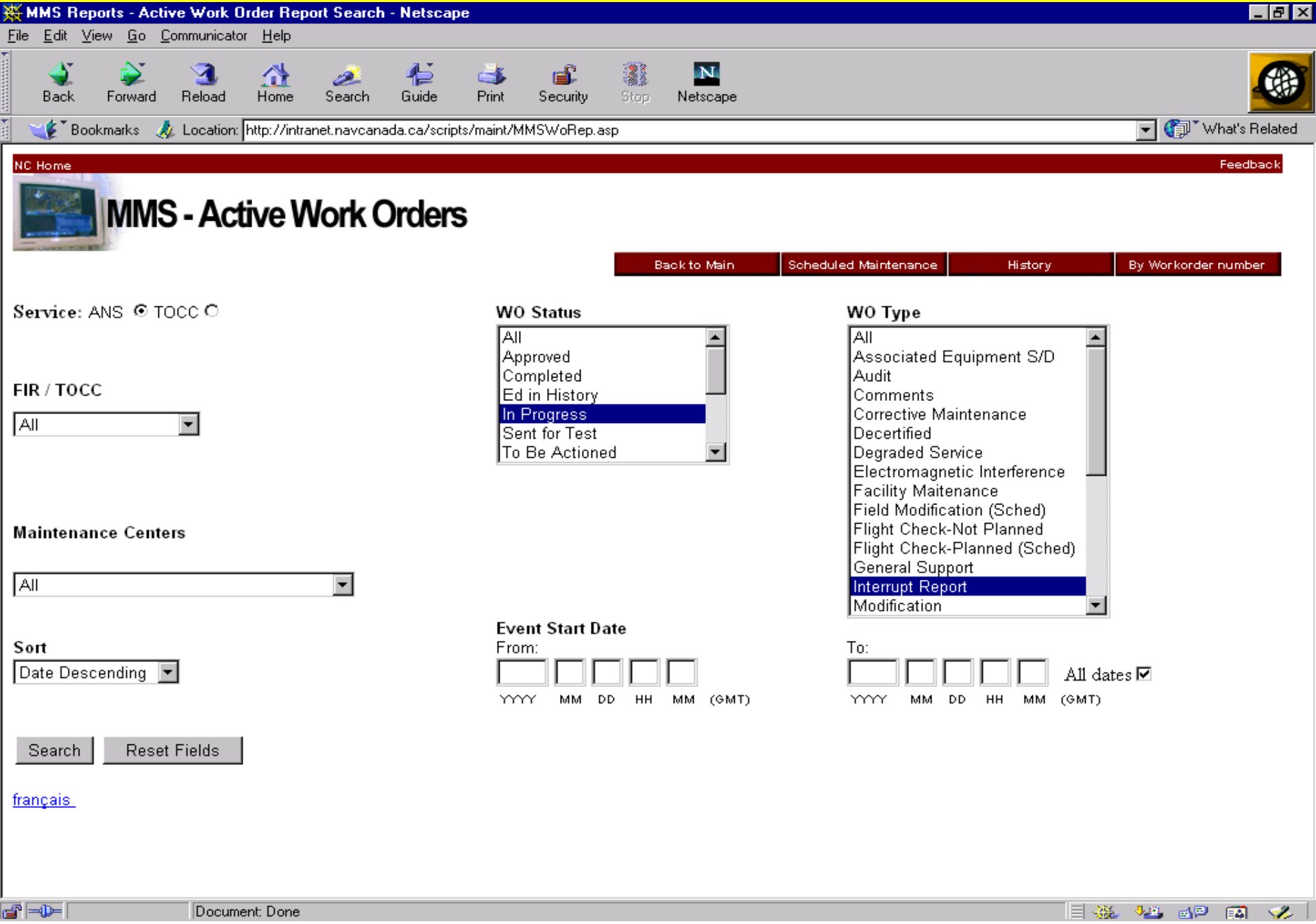
Work Orders and Certification Summary Produced/Produit: 2005/10/19 17:53

Sommaire des Bons de Travail et de la Certification Page 5 of 7

Highlighted in red when last certification date plus max limit has passed. Highlight in yellow when last certification date plus max limit is due within 7 days. / Accentué dans le rouge quand la date passée de certification plus la limite maximum a passé. Accentué dans le jaune quand la date passée de certification plus la limite maximum est due dans les 7 jours.

Lead Craft/ CM Principal	WO/ BT	Equip. No./ No. Équip.	Location/ Emplacement	WO / BT Description/	Job Plan/ Gamme d'opération	Targ. Start/ Début plan.	Cert Timeout Date/ Date d'échéance	Status/ Statut
RAD-YUL								
	YUL-743671		ASDE3-YUL	PM pour Park Air Systems ASDE3 - Dorval, HEBDO	5-3ASDE3-12-W	2005/10/05 07:01	N/A	WSCH
	YUL-743668	M559539	ADAP-OIDS2-YUL	PM pour ADAP, Tour de Montréal, YUL	5-6OIDS2-12/1-M	2005/10/12 07:01	2005-09-24	WSCH
	YUL-743672		ASDE3-YUL	PM pour Park Air Systems ASDE3 - Dorval, HEBDO	5-3ASDE3-12-W	2005/10/12 07:01	N/A	WSCH
	YUL-743723		SUPU-TSR-YUL	PM pour SUPU, Montréal TSR, YUL	5-9TSR-12/5B/5-10ISSR-12/5B/5-13SUPU-12-Q	2005/10/12 07:01	N/A	WSCH
	YUL-761594		ASDE3-YUL	PM pour Park Air Systems ASDE3 - Dorval, HEBDO	5-3ASDE3-12-W	2005/10/19 07:01	N/A	WSCH
	YUL-761595	M546241	BMR-UFX-YUL	PM pour Bmr du Ndb Ufx de St-félix-de-valois, 260 Khz, Yul	4-2BMR-12-A	2005/10/19 07:01	N/A	WSCH
	YUL-761597		IPU-TSR-YUL	PM pour IPU, Montréal TSR, YUL	5-9TSR-12/SA-Q	2005/10/19 07:01	N/A	WSCH
	YUL-761599		IPU-TWR-YUL	PM pour IPU, Tour Dorval	5-14IPU-12-M	2005/10/19 07:01	N/A	WSCH
	YUL-761621		ASDE3-YUL	PM pour Park Air Systems ASDE3 - Dorval	5-3ASDE3-12-M	2005/10/26 07:01	2005-05-09	WSCH
	YUL-761622		ASDE3-YUL	PM pour Park Air Systems ASDE3 - Dorval, HEBDO	5-3ASDE3-12-W	2005/10/26 07:01	N/A	WSCH
	YUL-761627		FAC-TSR-YUL	PM pour FAC, Montréal TSR, YUL	5-9TSR-12/6-SA	2005/10/26 07:01	N/A	WSCH

Maintenance Management System (MMS) Web Page



MMS List of Active Workorders

Address http://webapps/maximo/MMSLogList.asp Go Links Firewall L

NC Home Feedback

MMS - Active Work Orders

Back to Main | Scheduled Maintenance | History | By Workorder number

Note: All dates shown are in GMT format

Current Filter:	FIR/TOCC: (All) MC: (All) Service: (TECH)	Supervisor:
	Type: (IR)	Lead Craft:
	Status: (All)	Crew:
	Event Start Date: (All dates)	Log Labour Code:
	Sort: (Date Descending)	Log Type:
		Location:

Last Refresh: 2007/03/05 19:57

New Search

#	Work Order	Location	W.O. Description	Status	Type	
1	MEG-1077887	RCO-2971-4675-8891-11279-YYB-YCB	CB HF RCO's to YB u/s	INPRG	IR	20
2	MUL-1077844	DME-VBS	VBS DME alrm moniteur 1	INPRG	IR	20
3	MUL-1077829	NFDPS-ZUL	N58 papier	COMP	IR	20
4	MUL-1077825	ETMS-ZUL	ZUL ETMS U/S,DSC indique que ETMS fait planté NFDPS	COMP	IR	20
5	MVR-1077813	WTMD-ATB-YXT	XT WTMD U/S	INPRG	IR	20
6	MUL-1077808	NFDPS-ZUL	ZUL- Bornier ETMS U/S.	COMP	IR	20
7	MVR-1077806	FWGS-AOC-YKA	KA FWGS CPU pos 5 U/S	INPRG	IR	20
8	MUL-1077639	IIDS-YMX	MX- MX_08 Pas de polling.	INPRG	IR	20
9	MUL-1077618	ISSR-YFB	FB- Lien MDT A intremittant 05DYCE918991-000BLCA-000	INPRG	IR	20
10	MUL-1077589	XRAY-ATB-YOW	YOW Xray M21182 Bagage room red flashing	INPRG	IR	20
11	MQX-1077571	NDB-DP-YDP	DP (NAIN) NDB U/S	INPRG	IR	20

Done Local intranet

Detailed Work Order, In-Progress

Address http://webapps/maximo/MMSLogDetails.asp?SysID=TECH&WONUM=MEG-1077455&lang=1 Go Links Firewall L

NC Home Feedback

Back to Main

Note: All dates shown are in GMT format

Work Order:	MEG-1077455			Status:	COMP		
Location:	GP-IRB-YRB (Glide Path PHL7801 2C2F, Rwy 347T , Resolute Bay, IRB, YRB)			Event Start Date:	2007/03/05 03:17		
W.O. Description:	RB GP U/S TOC rectified.			W.O. Completion:	2007/03/05 15:59		
Work Type:	IR - Interrupt Report			Planned Target Start:			
Reporting Codes:	EQUIP, TBA, MREC			Planned Target Completion:			
Reported by:	SKANESR	AOR#:		Release Required?	Y	Response Priority:	2
Supervisor:		Lead Craft:		Crew:		Belongs To:	

Labour	Start Date	Start Time	End Date	End Time	Hours	Log Type	Log Details
TOC-YEG	2007/03/05	15:59			00:00	NIL	RB tech advised
TOC-YEG	2007/03/05	05:47			00:00	NIL	RB GP good for hour. Notam cancelled. Info for RB Techs in morning.
TOC-YEG	2007/03/05	04:48			00:00	NIL	AMCS able to connect. Able to pulse GP back on. Showing in green. Will monitor before cancelling notam.
TOC-YEG	2007/03/05	03:30			00:00	NIL	RB site has updated AMCS status on GP failure but AMCS still unable to connect to RB ILS.
FSS-YYB	2007/03/05	03:21			00:00	NIL	Artic Radio(Joane) received a call from the Cars stration (Andrew) That the RB GP had failed. AMCS shows green presentally. Unable to connect to get update. Notam GP U/S Till 070305 2359z.

Done Local intranet

•Total number of work orders generated:	**214,213**
• Average number of work orders per Month:	**17,851**
•Work orders type:	
Loss of Service or Equipment failure (IR)	7804
Preventative Maintenance (PM)	105393
Corrective Maintenance (CM)	40010
Field Modifications (FM)	4950
Second Level Support (SLS)	230
Degraded Service (DEGR)	23802
Decertified Systems (DCERT)	63
Release Requests (REL)	14627
Other	17334

AOR OCCURANCES STATISTICS BY SYSTEM (%)					
System	2003	2004	2005	2006	Total
Comm	11.96	17.92	14.99	12.56	14.70
ATM	18.27	16.89	24.70	22.15	21.24
ILS	16.61	17.24	14.75	11.57	14.79
NavAids	8.31	15.53	17.63	15.54	15.35
Other	4.32	1.71	0.36	0.33	1.20
Power	11.96	7.85	6.83	7.77	8.00
Radar	10.63	3.58	4.20	5.95	5.33
TelCo	17.94	19.28	16.55	24.13	19.39
Total	100	100	100	100	100

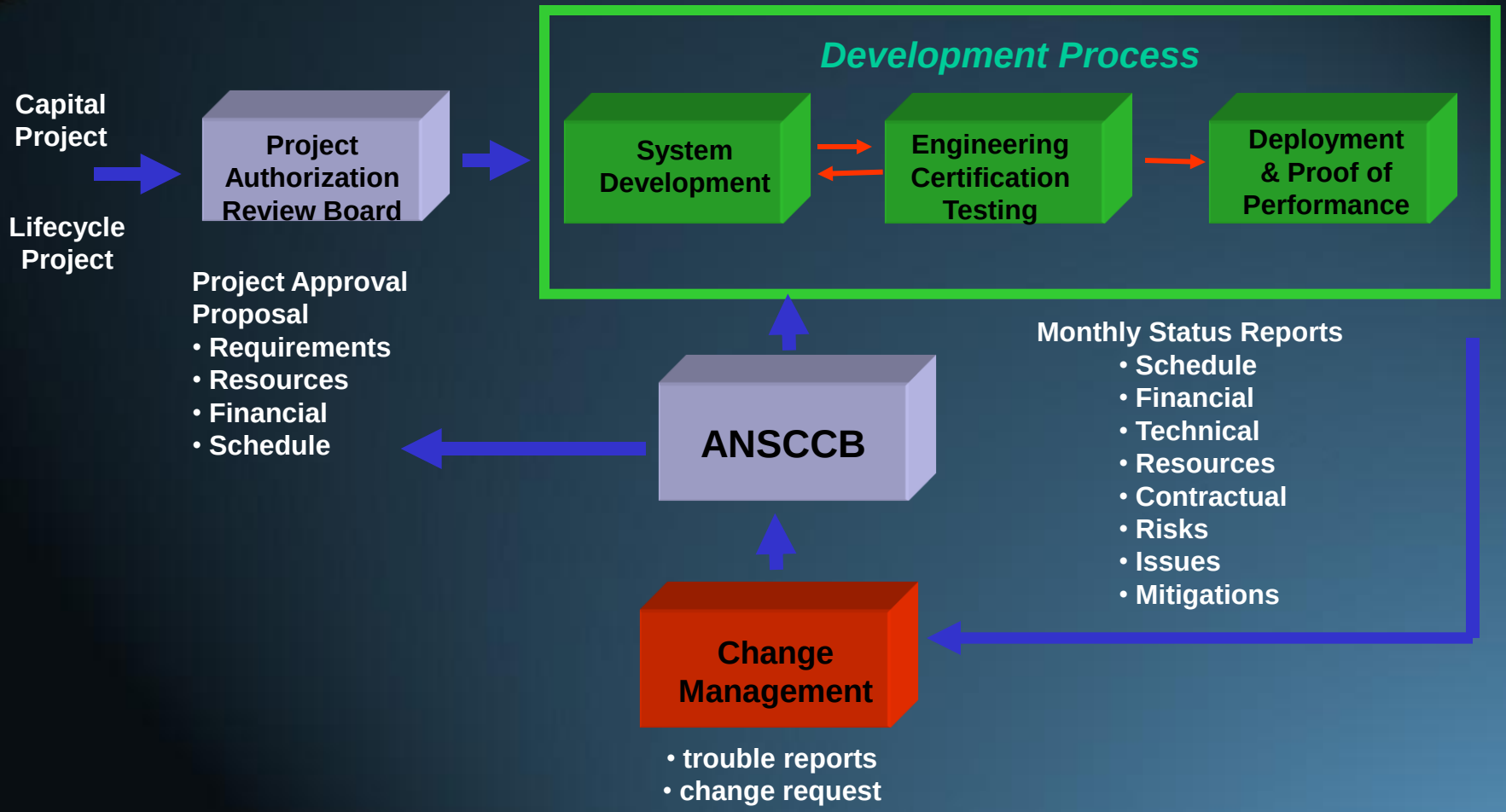
Level of Activity 2006

TOP 20
Workload Generators
March 2007

Location	Description	IR
XRAY-ATB-YVR	Xray ATB Vancouver, YVR	16
NFDPS-ZUL	Système National de Traitement des Données de Vol, Montreal, ZUL	11
TRACE-ATB-YVR	TRACE EDT (Explosive detection Terminals), ATB, YVR	8
ILS-IYQ-YYQ	ILS 33, Churchill 110.3, IYQ,YYQ	7
VIS-XRAY-ATB-YVR	VIS Integrated Baggage Xray ATB Vancouver, YVR	6
VSCS-ACC-ZUL	Voice Switch Control System, Dorval, ACC, ZUL	5
AFTN-YGL-1-YGL	AFTN, AT&T# IYNAF005, TELEBEC # 01FDDA865625	4
RSITWS11-RDPS-ZYZ	Flow Control, RSITWS 11, RDPS-ZYZ	4
XRAY-ATB-YYZ3	Xray ATB Toronto, YYZ3	3
RDPS-ZEG	Radar Data Processing System, Edmonton, ZEG	3
RVR-B-IJG-YHZ	RVR VIS Sensor B, Rwy 23, Halifax, IJG, YHZ	3
TAC-YJT	TACAN AN/GRN-516, 113.1 MHz Ch 78, Stephenville, YJT	3
FAA-MOCC-SI	FAA Mid-States Operations, Kansas	3
VDF-YQK	VHF DF ACI 8810, 122.2, 126.7, Kenora, YQK	3
IIDS-ZUL	Système intégré d'affichage d'information, Montreal, ACC, ZUL	3
VOR-YGH	VOR CMC8703, 112.3 MHz, Fort Good Hope, YGH	3
NATSIM-ZUL	NATSIM ZUL	3
DME-YBK	DME RYC7502, Ch 92, Baker Lake, YBK	3
XRAY-ATB-YVR-DOMESTIC-SOUTH	Xray Domestic South Security Point, ATB, Vancouver, YVR	3
XRAY-ATB-YYJ	Xray ATB Victoria, YYJ	3
Grand Total		97

Engineering Management

Overall Engineering Management Process



Engineering Management

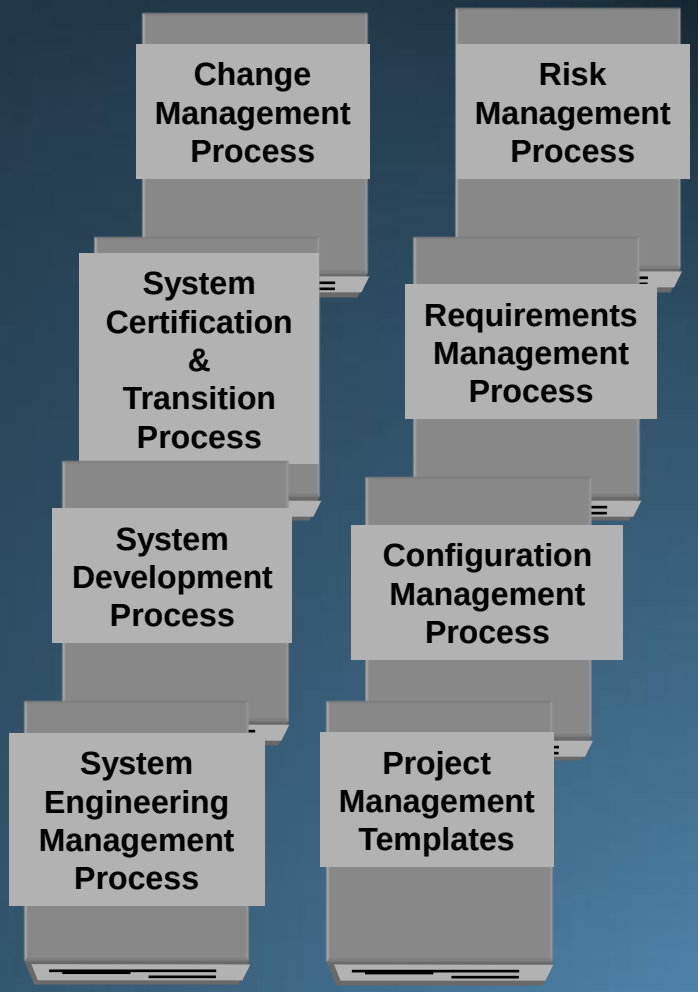
NAVCANADA staff (with limited contractor support) manages and performs Life-Cycle activities.

For many systems this includes:

- system engineering & design
- software design & development
- system integration (hardware/software)
- independent certification testing
- configuration management
- software releases & support services
- technical support to all field sites
- develop approved field modifications

Engineering Management Quality System

- Processes, procedures and guidelines that define a standard approach to System Engineering development and life-cycle support
- Applicable to all NAV CANADA engineering system development and life-cycle support projects
- Tailored according to System Safety Level
- System Engineering Management Plan (SEMP) confirms tailoring of EMQS for specific projects/system



Project Scheduling

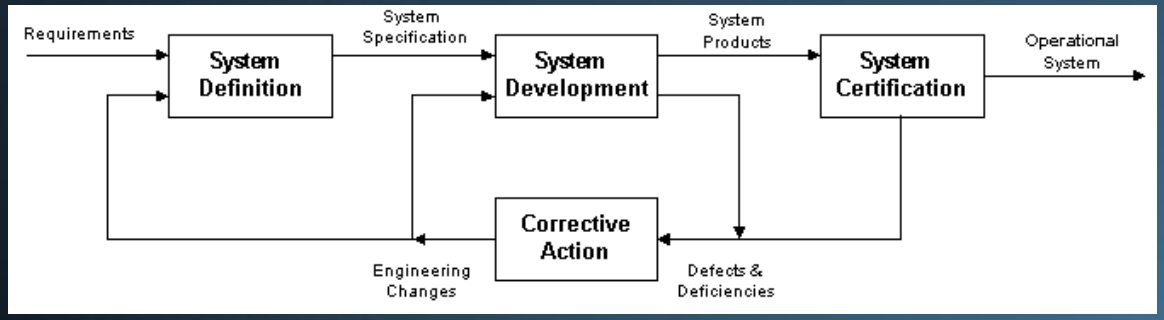
- **Implemented an integrated project scheduling process**
  - Utilizing MS project
  - Customized mandatory fields for reporting
  - Standard Project Template
  - Schedules tailored for size and complexity of project
  - Schedule updated by project managers directly
  - Mandatory status update monthly
  - Schedules are consolidated and reports published monthly available to stakeholders

Engineering Life-Cycle

NAV CANADA manages and performs the following

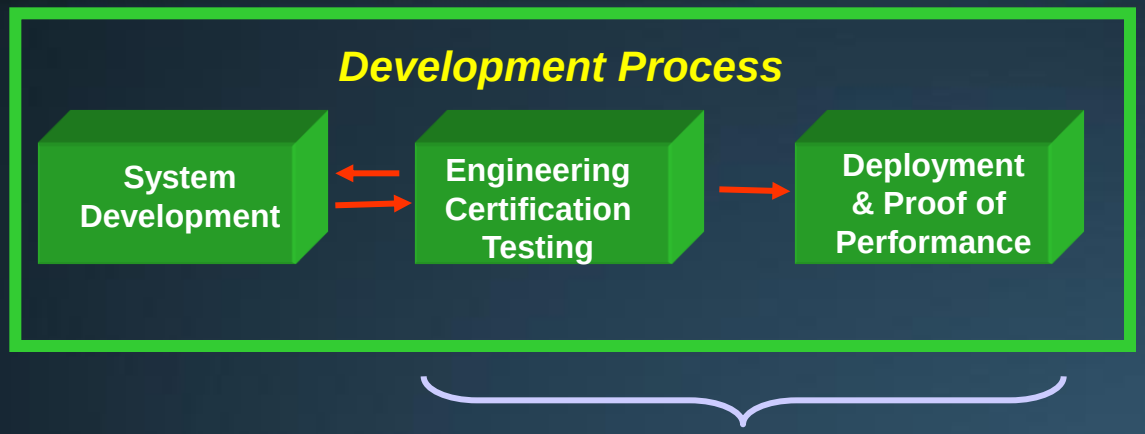
- System Definition
- System Development
- System Certification Test and Transition
- Change Management

Processes define the procedures & guidelines to be followed



Includes CM Plan, Audits, configuration items, control, etc…

Certification Testing



Testing Environment reflective of operational configuration – less combinations

Independent Testing Authority
Test-Bed Configuration Audits
Testing of Transition Plans

Quality Measurement

UCRs found in Eng. Certification
Iterations in Eng. Certification
UCRs found after deployment
Iterations in deployment

•S/W Interdependency –Testing priority - weekly review

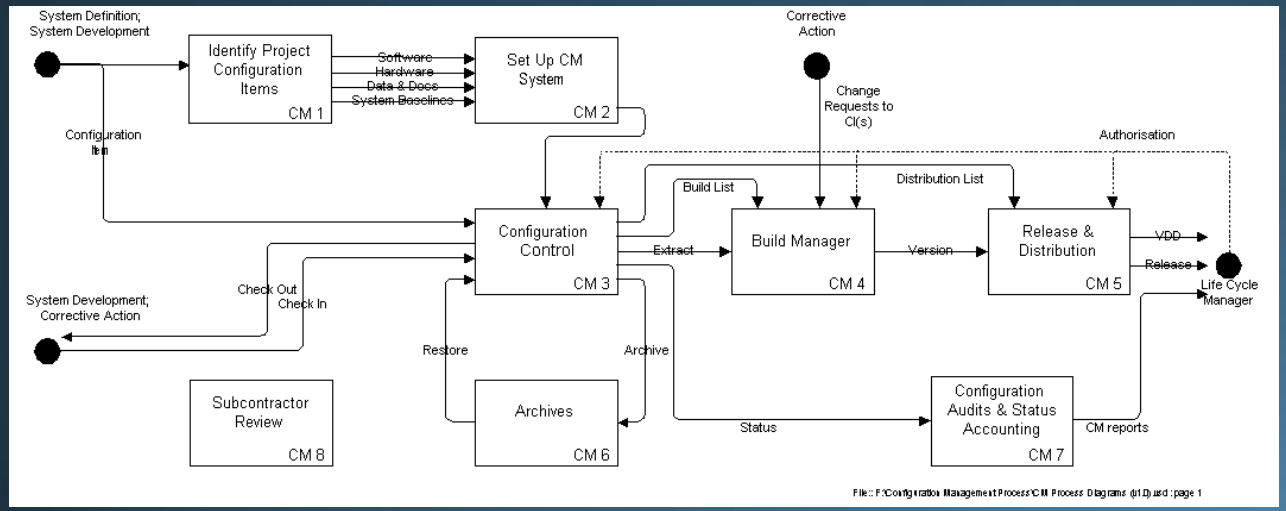
Engineering Safety Management System

- ESMS defines processes to be tailored to satisfy specific requirements
  - Safety Plan
  - System Safety Analysis
  - Safety Validation Plan
  - Hazard Log
  - Safety Validation (FAT, SAT)
  - Safety Case –evidence based

Configuration Management

CM Specific Objectives & Processes

- Our EMQS includes provisions for establishing and maintaining data on the status of identified configuration items and maintain the integrity of the work products throughout the products lifecycle.
  - Identify
  - Set-up
  - Control
  - Build
  - Release
  - Distribution
  - Archive
  - Audits
  - Status
  - Reviews



Requirement Traceability

- Requirement Management Plan established
- DOORS (Telelogic/IBM)
- End-User requirements linked to software requirements
- Acceptance tests linked to end-user requirements
- Engineering tests linked to derived (SW) requirements
- Supports code and test product reviews
- Analysis capabilities
  - used to confirms requirements coverage for software & tests
  - tracking of test results

Problem Reporting & Change Controls

- Problem Reporting
  - NESA (NAV CANADA Engineering Support Application)
  - Web based application based on Remedy
  - UCR- Unsatisfactory Condition Reports

- ANSCCB – Change Process
  - CP - Change Proposals
  - Life-Cycle Management Sort Committee
  - Prioritization/Authorization of changes
  - S/W implementation verification
  - Output – field modifications
  - Initial fielding testing of FMs

Unified Change Management

- On recent ATM projects:
  - Adapted the Rational Unified Process
  - Using ClearQuest & ClearCase toolset
  - Supports project specific processes/practices
  - All changes controlled and traceable
  - Concurrent support for multiple target platforms
  - Applied in an iterative development approach
  - Applied in a multi-site development configuration
  - Supports evidence-based integrity assurance
  - Facilitates internal and external audits

ED-109 Software CM Process Objectives

- Applied on recent ATM projects/systems
- Applicable to all Assurance Levels
- Auditable, evidence-based process
- Approach is seen as beneficial across all aspects & wider application is under consideration

	Objective		Applicability By Assurance Level				
	Description	Ref.	AL 1	AL 2	AL 3	AL 4	AL 5
1	Configuration items are identified.	7.2.1	❍	❍	❍	❍	❍
2	Baselines and traceability are established.	7.2.2	❍	❍	❍	❍	❍
3	Problem reporting, change control, change review, and configuration status accounting are established.	7.2.3 7.2.4 7.2.5 7.2.6	❍	❍	❍	❍	❍
4	Archive, retrieval, and release are established.	7.2.7	❍	❍	❍	❍	❍
5	Software load control is established.	7.2.8	❍	❍	❍	❍	❍
6	Software life cycle environment control is established.	7.2.9	❍	❍	❍	❍	❍

CM Toolset

Examples (variances between systems & projects)

- Requirements Management
  - Telelogic DOORS + project specific tools
- Defect & Change Tracking
  - NAV CANADA Engineering Support Application (NESA)
    - Based on Remedy ARS - LCM
  - Rational ClearQuest
  - Programmer Work Instructions (PWIs)
- Configuration Management
  - Rational ClearCase,
  - Rational Apex CMVC (Integrated with Remedy ARS)
  - SCCS

Configuration Management
Future Opportunities

Configuration Management Future Opportunities

- MAXIMO/NESA
  - Integration of System Maintenance & Change Management tools
    - Defect Report → Review → Change Control → Defect Resolution → Software Release → Field Modifications → Implementation
- Validation of Adaptation Data
  - On-site adaptation and validation systems
  - For new releases, 56-day update cycles and other instances
- Training Systems
  - Increased fidelity and training specific functionality
- Integrated Safety Management System
  - Engineering, ATC Operations, Technical Operations