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WHAT BARRIERS EXIST TO THE IMPLEMENTATION OF A UNIQUE JTDL CAPABILITY WITHIN THE CF?

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Par le maj Beauchamp

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GLOSSARY

ADLS: Advanced Distributed Learning System

ADM(IM): Assistant Deputy Minister of National Defence for Information Management

ADSI: Air Defence Systems Integrator. ADSI is a family of products designed to meet many of today's Command, Control, Communications, Computers, and Intelligence (C4I) requirements. The ADSI system is essential to the military's command and control structure. This robust system is capable of receiving, forwarding, and displaying tactical information via tactical data links, radar, intelligence links, and other means. It gives operators a versatility they have not previously enjoyed, even with other more costly systems. The ADSI is also a real time tactical command and control system that receives, forwards, and displays tactical information. It can have up to 16 Tactical Data Links (TADIL) that communicate with systems like the Patriot, AWACS, ships, Command centers, and radars. From: http://www.army.forces.gc.ca/4air_def_regt/equipment.html

ALI: Air/Land Integration

ASCC: AirSpace Coordination Center. The ASCC is the facility into which the various airspace users provide inputs concerning their requirements, where conflicts between users are resolved, and requirements are consolidated and forwarded to HIGHER for approval. In essence, the ASCC determines how the commander's airspace requirements can best be satisfied by maximizing the effective safe use of the airspace with minimum restrictions. This allows the flexibility of airspace use in an efficient, integrated and flexible manner, and provides a commander with the operational flexibility to effectively employ forces in times of conflict. From: http://www.army.forces.gc.ca/4air_def_regt/equipment.html

BFT: Blue Force Tracker

C2: Command and Control

C4I: Command, Control, Communications, Computers, and Intelligence

CANR: Canadian NORAD Region

CAOC: Combined Air Operations Centre

CFICC: Canadian Forces Integrated Command Centre

CLEW: Conventional Link Eleven Waveform

CONOPS: Concept of operations

COP: Common Operational Picture – The integrated capability to receive, correlate and display a common tactical picture that incorporates planning applications and theatre-

generated overlays/projections. It will also display other pertinent information relevant to operational and strategic C2 including, but not limited to, information from the joint operational planning and execution system, status of readiness and training system, the Global Reconnaissance Information System, and Air Tasking Officer messages.
CTP: Common Tactical Picture - An accurate and complete display of relevant tactical data that integrates tactical information from the multi-TDL network, composite tracking network, intelligence network, and ground digital network. The CTP enables C2, situational awareness (SA), and combat identification (CID), as well as supporting the tactical elements of all joint mission areas. The CTP, along with information from the joint planning network (JPN), contributes to the common operational picture (COP)

COTS: Commercial Off The Shelf

DLR: Directorate of Land Requirements

DND: Department of National Defence

DRDC: Defence Research and Development Canada

EBO: Effects Based Operations

EMS: Electro Magnetic Spectrum

GBAD: Ground Based Air Defence

IER: Information Exchange Requirements

IFF: Identification Friend or Foe

IP: Internet Protocol

JDNO : Joint Data Network Officer. The JDNO coordinates with component commanders or command elements as directed by the Joint Force Commander (JFC). The JDNO is responsible to the JTF J-3 (Operations) with support from the J6, for Joint Data Network (JDN) operations and integration of information from the subordinate networks in support of the Common Tactical Picture (CTP). The JDNO is responsible to the JFC to provide an accurate, timely display of selected tactical data, supporting a JTF through the integration of JDN information.

JICC: Joint Interoperability Control Cell.

JICO : Joint Interface Control Officer. The JICO is the senior interface control officer (ICO) in support of MTDL operations and is the MTDL coordinator for the JDN. When a JTF is formed, there will be only one JICO per JTF. The JICO will normally be located in a command and control facility with RF connectivity to the primary TDL. The JICO organization, led by the JICO, operates within a JTF. The mission of the JICO organization is to plan, execute, and manage the MTDL within the JFC's AOR. The JICO controls and acts as the coordinating authority for the Joint Interface Control Cell (JICC), Regional Interface Control Officer (RICO) and Sector Interface Control Officer (SICO) for planning and execution functions that cross regional and/or sector boundaries or impact the theatre-wide MTDL. Increased emphasis on joint integration and information exchange requirements has placed greater demands on interface planning, execution, and management. These increased demands require that the JICO be formally trained in joint MTDL operations. This formal training will supplement, but not replace, specific operational and MTDL training and will build on that foundation to provide essential skills to plan and execute the joint Multi-Tactical Data Link Networks (MTN)

JTFP: Joint task Force Pacific

JOA: Joint Operation Area

JREAP: Joint Range Extension Applications Protocol. Provides a means of exchanging tactical messages over a variety of long haul media, such as landline or satellite, in order to achieve BLOS communication

JTAC: Joint Terminal Attack Controller. Directs the action of combat aircraft engaged in close air support and other offensive air operations.

JTDLMC: Joint Tactical Data Links Management Coordinator

JTIDS: Joint Tactical Information Distribution System. JTIDS describes a secure, high capacity, ECM-resistant communication system operating within the UHF band between 960-1215 MHz (L-band); relay support has been incorporated into the system design in order to extend the range BLOS.

JTT: Joint Tactical Terminal. JTT is a high-performance software-programmable digital intel radio. Its plug-and-play modular functionality accesses the current intelligence networks and enables forward compatibility for the Integrated Broadcast Service (IBS). Instant access to complete, accurate, and timely tactical intelligence and targeting information supports battle managers, intelligence centers, air defenders, fire support elements, and aviation nodes for airborne, sea-going, subsurface, and ground mobile platforms.

Link16: A secure, jam-resistant, high-capacity, node less tactical digital data link, also known as TADIL J, which utilizes the MIDS / JTIDS terminal and its TDMA architecture for multinetted communications. The information exchanged on this link is conveyed in the J-series messages and conform to the operational specifications contained in OS-516.1

LVT: Low Volume Terminals

MIDS: Multifunctional Information Distribution System. This system combines characteristics designed to overcome many of the limitations common to existing systems by providing for increased system capacity and coverage, improved connectivity, survivability, jamming resistance, and reduced danger of data loss and data obsolescence.

MULTOTS: Multi-Unit Link Testing and Operational Training Systems

NCI Ops: Naval Combat Information Operators

NEOps: Network-enabled Operations

NORAD: North American Aerospace Defence Command

OP PODIUM: The Canadian Forces (CF) was tasked to support the Royal Canadian Mounted Police (RCMP) in security efforts for the 2010 Olympic and Paralympics games. This mission was labeled a no-fail mission by the Chief of Defence Staff (CDS). In order to fulfill their mission the Joint Task Force – Games (JTF-G) and Canadian NORAD Region (CANR) employed a JICC which subsequently created a JICC – Deployed (JICC-D).

Purple: I will be using the term “Purple” throughout this essay as a term to represent the effort of representing the three services of the Canadian Forces and other agencies in a joint cell responsible for the coordination of information from all sensors in one functional coordination center.

RAP: Recognized Air Picture

SADL: Situational Awareness Data Link. SADL facilitates the integration of CAS with the digitized battlefield via EPLRS providing fight-to-fighter, air-to-ground and ground-to-air communication. Since EPLRS is part of FBCB2, friendly troops are able to receive aircraft position and altitude data.

SLEW: Single tone Link Eleven Waveform

SMEs: Subject Matter Experts

STE: Secure Terminal Equipment. The Tactical/STE provides direct connection to tactical communication systems in the field as well as offering full office features and connectivity for use in garrison. The terminal incorporates FNBDT/SCIP signaling to provide wireless and foreign interoperability.

TADIL: Tactical Data Information Link

TBMs: Tactical Ballistic Missiles

TDL: Tactical Data Link is military communication links, developed for the transmission of digital tactical information using standardised message formats, protocols and bearer characteristics. TDLs facilitate secure, ECM-resistant communication between military assets.

TDMA: Time Division Multiple Access. Is a method of digital wireless-communications transmission. TDMA allows many users to access (in sequence) a single radio-frequency channel without interference, because it allocates unique time slots to each user within each channel.

UAVs: Unmanned Aerial Vehicles

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I would like to express my sincere appreciation for all of the help given from CPO2 Sid Tobias, Major Ken Mahon and Capt Adrian Mirosnikov. You are truly the backbone of this unique capability and your insight in this matter was truly essential to the formulation of this paper. It is hope that we will together be able to convince the leadership of the Canadian forces of the importance of centralizing the JTDL capability where it will have the best impact on both domestic and expeditionary operations in the near future. To Dr Paul Mitchell, your patience and understanding is also well appreciated and were instrumental to this achievement. I would also like to acknowledge the support provided by Dr. Eric Ouellet in providing me the necessary material needed in order to formulate my last chapter. Special thanks to Major Richard Deschambault, Major Mark Gasparotto and LCol Gary Whelan for technical support during the preparation and the revision of this paper.

ABSTRACT

Joint Tactical Data Link is inherently one of the most joint endeavour in today's military. Coordination and integration of maritime, air and ground assets can be the key to successful operations in any future military environment. Command, control and coordination at the operational level can set the stage for success or failure. Advances in technology, changes in warfare and transformation of Canadian forces organization have led to rapid change in the world of the integration of the joint battlefield. Doctrine publications at all levels struggle to keep pace with changes. Further more, organizational structures and social and cultural issues are an intrinsic part of the barriers that will constitute the main focus of this essay. With these problems in mind, the primary question is whether information technology has become a ubiquitous and increasingly significant part in the development within the Canadian forces.

This paper starts with a historical review of information technology in the context of conventional warfare. It then compares current Joint, Air Force, Army and Allied publications to understand how battlefield coordination has evolved. Professional journals and lessons learned articles for operational theatres and domestic operations such as PODIUM and CADENCE are reviewed to identify disconnects with the current doctrine that might suggest there is an additional requirement for the new doctrine to further develop and evolve. Finally, the analysis of these impacts for the Canadian forces as a whole will be conducted using the approach of Chase & Poole: The surface of emergence in systems

development and Lin and Silva: The social and political construction of technological frames.

This thesis confirms that the new joint environment essential to the conduct of our entire operations has severely and truthfully changed the way joint coordination of the battlespace must be done. It also brings some recommendations and possible solutions to improve the critical connectivity and interoperability of joint and combined operations. The challenges go to the human dimensions as it relates to the nature of the different trades, command styles, and challenges posed by the operating environments in which the three services find themselves conducting operations. To magnify the complexity with respect to integration of the TDL in the CF are the issues of the small size of the CF and the budgetary limits on the force. The lessons learned from Theatre and Domestic Operations (DOMOPS) should convince the three elements of the necessity to find and implement a Joint and deployable solution.

GENERAL BACKGROUND

1.1 – INTRODUCTION

> *"The key lessons observed during OP PODIUM lead to the recommendation that a joint commander must be assigned to manage a single integrated TDL architecture within Canada. It is hoped that this experience will stimulate dialogue on the requirement for a national TDL policy and the mechanisms through which to best manage this important joint capability."*[1]
>
> *- T.H.W. Pile, Rear-Admiral, Commander Joint Task Force Games*

Barriers exist to the implementation of a unique Joint Tactical Data Links (JTDL) capability within the Canadian Forces (CF). The central issue of defining and counteracting these barriers will delineate the thesis of this paper. Once the central issue is defined, there are other are sub elements that must be answered. These sub-elements include the planned role, best location, and how to integrate this TDL capability into the three services, namely the Army, Navy and Air Force. In addition the paper will discuss the need for the CF to manage and disseminate the Common Operational Picture (COP) provided by the TDL. The challenges of developing such a system are not strictly technological. The challenges refer as well to the human dimensions, as it relates to the nature of the different trades, command styles, and challenges posed by the operating environments in which the three services find themselves. Complicating these challenges are the issues of the small size of the CF and the budgetary limits on the force.

[1] MARPAC-#99360-v1A-BRIEFING_NOTE_-_TACTICAL_DATA_LINK_-_WAY_FORWARD_(ACC_JTFG_RDIMS_99360)

This paper will identify, analyze and summarize the integral challenges related to the implementation of this unique JTDL capability It argues that a centralized JTDL is necessary within the CF to ensure support to operations and counteract environmental service biases. The CF has learned much from recent domestic and expeditionary operations, such as the deployments in support of the Olympics, the recent G8 and G20 meetings, as well as ongoing operations in Afghanistan, and finally, the importance of the COP especially with respect to air environment. The paper will discuss organizational structures and how they can influence the development of these technologies. The adoption of techno-centric developmental approaches and its social and cultural implications will be looked at in detail in order to explain how they can be adapted within the organizational context.

1.2 - GOALS OF THE DISSERTATION

Through analysis of the barriers to a centralized JTDL, the dissertation will dispel the barriers and provide conclusive evidence of the need for this unique capability to be outside of the control of the environmental services.   This paper will provide CF leadership with the ammunition to champion TDL from mission definition through to operational capability. The purpose of this essay is to identify some of the challenges and key lessons learned from OP PODIUM and Theatre related to the integration of TDL for the Canadian Forces, focusing on the difficulties of integrating all of the hardware and different operating systems that communicate in their own device-specific language.

The paper will assert that the CF has a requirement for a centralized Joint Interoperability Control Cell (JICC) formed by subject matter experts (SMEs) from all three elements in order to manage properly all aspects of TDLs. One critical aspect is the need to operate all communication systems to fulfill efficiently our commitments within the North American Aerospace Defence Command (NORAD) and to correlate and integrate our Common Tactical Picture (CTP) with our allies' Common Operational Picture (COP).[2] TDL, employing Link 16 and Link 11 and delivering the CTP, spans all environments and is required across the Joint Operation Area (JOA). Most JOAs are complex joint, multinational and coalition environments, which adds to the difficulty of integrating the COP. Indeed, limitations in equipment and qualified personal pose significant difficulties in establishing an interoperable JTDL capability for expeditionary and domestic operations.

These difficulties are centered on five major issues: Lack of ownership, limited assets, technical expertises, spread of resources and qualified personnel, and the present construct. The lack of ownership refers to the different platforms forming the capability that are owned by the three elements forming the Canadian forces. For instance, the Air Force owns most of the sensors; yet the Air Defence System Integrators' (ADSIs)[3] are shared between the Navy and the Army. Finally, only eight of the eighteen integrators owned by the CF reside within the Army with very limited amount of radios and related equipment needed

[2] CTP: Common Tactical Picture - An accurate and complete display of relevant tactical data that integrates tactical information from the multi-TDL network, composite tracking network, intelligence network, and ground digital network. COP: Common Operational Picture – The integrated capability to receive, correlate and display a common tactical picture that incorporates planning applications and theatre-generated overlays/projections. It will also display other pertinent information relevant to operational and strategic C2 including, but not limited to, information from the joint operational planning and execution system, status of readiness and training system, the Global Reconnaissance Information System, and Air Tasking Officer messages.

[3] ADSI is a family of products designed to meet many of today's Command, Control, Communications, Computers, and Intelligence (C4I) requirements. The ADSI system is essential to the military's command and control structure. This robust system is capable of receiving, forwarding, and displaying tactical information via tactical data links, radar, intelligence links, and other means. It gives operators a versatility they have not previously enjoyed, even with other more costly systems.

to create a functional entity. At present time, only two complete functional entities can be deployed at any given time as explained by the deficiencies identified in appendix 2.

The technical knowledge is also lacking, in the sense that too few technicians and operators are qualified. It takes the better part of two years to train and qualify one JICO and one year to qualify technicians. Exacerbating the problem are the issues of career progression and postings which proves detrimental to conserving this unique expertise. This problem is very important in the context of decentralization and causes qualified personal to leave when posted back to their MOS related employment and seek civilian employment within the TDL community. These job opportunities are very lucrative in nature and bring that family stability for which many personnel strive. Finally, the spread of the equipment and expertise within the three elements, affects negatively on the ability to force generate this capability when required. OP HESTIA is a prime example when all primary equipment and personnel were in Port-au-Prince within five days and ready to establish some airspace coordination at the airport but some of the secondary equipment to ensure the functionality of the system were shipped by different organisations such as Intelligence, Surveillance, Target Acquisition, and Reconnaissance (ISTAR), the Air Force (AF) and was not available.[4] The Americans have an integrated system and they assumed this function of airspace coordination and integration within ten days decreasing Canada's possible operational and strategic effect by sending back our technicians to Canada within two weeks reducing our commitment and an excellent opportunity to prove the capability in the field of JTDL.

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[4] This was observed by the author while employed as 2ic 4 Air Defence Regiment and responsible for the Force Generation of this capability for OP HESTIA.

A literature review will bring into the paper issues raised by previous studies and discuss the aspects of evolving technologies, and the emergence in systems development. Some of the reviews are related to the development of interoperability, capacity of the systems to interface and to use the same language. An important Operational Research paper entitled Tactical Data Links Study conducted by the Defence Research and Development Canada (DRDC) in 2010 provided the Canadian Joint Tactical Data Links Management Cell (JTDLMC) and the Air and Space Interoperability Council with a description of TDL capabilities and limitations.[5] Other key documents will also be analysed in order to formulate recommendations for the development of JTDL capability, such as the Joint Tactical Data Link Management Cell (JTDLMC) brief to the Data Link Advisory Panel (2008), the Tactical Data Links capability development Study**,** DRDC 3554-1 (H/Air Section) by J.A. Steele (2010), and a paper by D. Griffith on coalition airspace management and deconfliction (2006).

To assist in the understanding of the social and cultural implications while developing a new Information System, or in updating an existent one such as JTDL, one main document and four case studies will be reviewed. A document from Neil F Doherty and Malcolm King focuses on the transition from the technical to the socio-technical change; basically how to tackle the human and organizational aspects of systems development projects. The four case studies enable a better comprehension of the concepts related to the social aspects of Information Systems development. They are based on the work of Federico Iannacci: <u>When is an information infrastructure? Investigating the emergence of public sector information</u>

[5] A.E. Turnbull, *Directorate of Air Staff Operational Research*, Tactical Data Links Study**,** DRDC CORA TM 2010-034, March 2010

infrastructures; Bongsug Chae and Marshall Poole: The surface of emergence in systems development: agency, institutions, and large-scale information systems; from Angela Lin and Leiser Silva: The social and political construction of technological frames; and finally from Luis F. Luna-Reyes, Jing Zhang, J. Ramo´n Gil-Garcı´a and Anthony M. Cresswell: Information systems development as emergent socio-technical change: a practice approach.

The analysis of these studies at the presentation of background information on TDL architectures will develop the conceptual understanding leading to the demonstration of the thesis. This will identify the issues which will need to be addressed in the future to allow the integration and interoperability of the CF system with different TDLs in a joint and multi-national context.

1.3 - WHY IS THE CAPABILITY NEEDED?

Interface operations can be summarize by the exchange of data’s between coalition partners and other government agencies during conflicts when different protocols that corrupt the picture are integrated into the COP. Interoperability is the ability of systems to accept and to use data to enable them to operate effectively together. In tactical systems, interoperability has five critical steps: hardware; protocol; message structure; implementation; and, tactics, techniques and procedures. At the moment, the systems available are not integrated in an interoperable manner, which limits coordination and disrupts the information exchange flow. When Tactical Data Systems (TDS) are linked together through a digital interface the individual systems are functionally tied together. All actions in any one system are reflected in all or in part of the other systems’ Interface Units. This digital interconnection creates a much higher degree of interoperability than has previously been possible. TDS having a digital connection are no longer considered autonomous units that simply exchanges information with one another; they work in unison. Centralized direction and coordination of interface operations is therefore necessary to preclude disruptive conflicts in the information that is exchanged.

On operations, the integration of different nations' networks will normally be conducted at the theatre level and below. Responsibility for the integration of all available feeds and the coordination in gaining full access to coalition assets rests with the Theatre Commander.[6] However, in order to specify the protocols and the different feeds to be used, the Theatre Commander normally delegates the management authority of the multi-link interface to the Joint Interface Control Officer (JICO)[7], through the Joint Forces Air Component Commander (JFACC). Currently the JICO reports along side both the Joint Data Network Operations Officer (JDNO), who is responsible for operational level planning, in coordination with the Elemental Component Commanders. The JICO is responsible for establishing the initial functions of the interface and joint network as well as subsequent change requirements. Under the authority of the JFACC, the JICO may establish region/sector interface control officers (RICO/SICO). To provide the necessary information to the JICO - and thus to the commander - and enable a coordinated and efficient response, it becomes necessary to insure that the systems can work together.

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[6] Air Force CONOPS for Data Link 3030-1, dated 05 Dec 2008 (A3 TDL Mgr), p.10.

[7] From CJCSM 3115.01A, Joint Data Networks (JDN) Operations, 5 February 2007: The Joint Interface Control Officer (JICO) is the senior multi-tactical data link interface control officer in support of joint task force operations. The JICO is responsible for effecting planning and management of the joint tactical data link network within a theater of operations.

1.4 - PAPER OUTLINE

The barriers that exist in the implementation of a unique joint tactical capability for the CF are complex and multifaceted. There are technical, but also environmental and societal issues to deal with; for example, the resistance to a joint environment and the competition between the three services. This paper will attempt to identify the complexity of the JTDL and to suggest a framework that will allow resolution of these barriers. Chapter 2 will briefly discuss the origin and development of digitization and TDL evolution through the early stages of the post-Cold War period. The developments, key concepts and definitions of this information digitization will be looked at from an historical perspective by showing how ideas and devices are linked through politics and culture (Edwards). Explanation of these concepts will provide the necessary canvas from which the paper's key tenets will flow. The key tenets are: isolation of the system within each service, difficulties of interoperability caused by this isolation, and competition within those services.

Chapter 3 will focus on the human dimensions related to the barriers hindering the implementation of a centralized, integrated JTDL. To this effect, an analysis of the case studies conducted by Chae & Poole (2005), Lin & Silva (2005), Luna & Reyes et al (2005), and Iannacci (2010), will show the relation between each study. These will identify the difficulties produced by the human effects on the acquisition, production and maintenance of an integrated, interoperable system. As the human dimension creates pressure on the system's development, how can these be alleviated? This will allow the formulation of key recommendations to identify areas where further research may be needed, and to propose how to rationally use the constraints of systems development in order to maximize integration of JTDL within the Canadian forces.

Chapter 4 will describe the existing barriers to implementation of an efficient, joint and integrated TDL within the CF, highlighting the challenges caused by lack of cohesion and equipment correlation between the three services, as indentified during the lessons learned process after the recent CF expeditionary and domestic operations, namely OP ATHENA, OP CADENCE and OP PODIUM. These operations identified that at a minimum, the capability exists to create a national joint integrated picture, but that the number of sites limits this capability. This chapter will identify possible locations for the establishment of a permanent JICC but also the constraints related to having the available systems integrated. Constraints such as the human and structural dimension will be identified, especially the incidence and propensity to system failure during the conceptualization period.

Chapter 5 will discuss the challenges related to the acquisition of the equipment needed, including the pervasive effects of the unbalanced structure under which the CF are attempting to develop this capability, such as the development of an acquisition management plan which will take into consideration budget consideration and services input, needs and concerns. Finally, the problems related to training and maintaining the adequate skill sets such as the management of career and training strategies and the possibilities will be discussed. Chapter 6 will summarize the findings of the research and the suggestions on where future research and study can be focussed in order to continue advancing the CF’s JTDL work.

1.5 - SUMMARY

TDLs are Command and Control systems and thus are not a standalone capability. Their operational value is holistic, in the sense that they enable tactical networked-operations (Network Enabled Operations) amongst numerous critical capabilities operating within the Joint battle space. Each environment employs individual operating procedures incorporating the TDL. However, TDL crosses all environments. It cannot be the “Chasse-Gardée” of any individual environment; thus a collaborative and cooperative approach must be employed for future operations.This thesis argues that the new joint environment essential to the conduct of our entire operations has dramatically changed the way joint coordination must be conducted. It also proposes concrete steps to achieve substantial improvements in this critical area of joint and combined operations. Finally, and most importantly this thesis demonstrates that there remain significant areas for future research and analysis as technological advances continue to redefine the complexity of Joint Tactical Data Link management in peace and war.

CHAPTER TWO

HISTORICAL BACKGROUND

2.1 – INTRODUCTION

"When defining the battlespace there generally are six dimensions to be considered. These are Land, Sea, Air and Space, Electro Magnetic Spectrum (EMS), Computer Generated Space (cyberspace) and Time."[8] All of these dimensions are complementary to each other and a close coordination is needed in order to ensure that the proper controlling authority is in place to avoid any blue-on-blue fratricide. In addition to these dimensions forming the battlespace, "the Intertwining of civilian and military operations along with recent theories such as Effects Based Operations (EBO)[9] has fuelled a growing belief that local populations, the human dimension, also comprises part of the battlespace."[10] The future battlefield will necessitate the use of data links in order to locate, track and target almost instantaneously the enemy forces.[11]

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[8] United Kingdom. Ministry of Defence, "Battlespace Management," in *Army Field Manual - Combined Arms Operations*, Vol. 1 (London: Ministry of Defence, 2007), 1-1.

[9] From AFDD2, dated 3 Apr 2007: "Effects-based operations (EBO) are operations that are planned, executed, assessed, and adapted to influence or change systems or capabilities in order to achieve desired outcomes."

[10] M.F. Notaro. Command, Control and Coordination of the Third Dimension: The Evolution of Army Airspace after the Cold War. 21 April 2010, p. 13.

[11] Paul N. Edwards. The closed world. Computers and the politics of disclosure in cold war America. Massachusetts Institute of Technology, 1996, p. 43.

2.2 - THE ORIGINS OF INFORMATION DIGITALIZATION

The utilization of the battlespace has been instrumental and has contributed to the conduct of all of the military operations for the last century. "Since the first military use of aircraft for reconnaissance during World War I, the ability to project military power into the third dimension gained ever increasing importance to the successful prosecution of military operations."[12] The dominance and the coordination of air breathing assets in the third dimension were already very important during the First World War but become paramount during the conduct of the Second World War. The number of aircraft during the Second World War operating within the confines of the same area required an extensive coordination and was the source of airspace management of today. It is important to note at this point that the integration of air and land components were more procedural[13] because of the lack of proper communication resources. Unfortunately, many of the valuable lessons learnt during this period were forgotten in the post-war demobilization. "Each Service developed doctrine and tactics based on their independent view of the employment of airpower, views that were consolidated and entrenched during the standoff of the Cold War."[14]

The period following the end of the Second World War, the Cold War, saw an important evolution in doctrinal approach to airspace management and operations at the

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[12] Griffith, David. Coalition airspace management and deconfliction. *11th International Command and Control Research and Technology Symposium: Coalition Command and Control in a Networked Era*. 6 June 2006, pg 1.

[13] Procedural control refers to the use of airspace control measures and coordination levels through the production of ACOs described in the NATO doctrine in place ATP-40 (B) and now replaced by NATO AFP 3.3.5 (A) NATO. *AJP 3.3.5(A) Doctrine for Joint Airspace Control*. Brussels: NATO, 2006.

[14] *Ibid*, pg 1

international level. The North Atlantic Treaty Organization (NATO) quickly developed alliances that put in place a new doctrine that regulated the use of the airspace with different partners operation in a joint environment. This new doctrine was also encompassing of all of the problems identified in the command and control of all airspace users under a centralized structure. This centralized structure was established under the development of what will become the CAOC[15] in the mid-90s. "Air operations were planned and coordinated by the Combined Air Operations Centers (CAOCs), but were undertaken by national elements operating in segregated areas over which they retained operational control."[16] These segregated areas were at Division and Brigade levels utilizing some decentralized Coordination cells such as the Divisional Air Defence Cell (DADC). During the Cold War, the US military's attempts to develop a more effective way of coordinating air assets by employing a concept of centralized authority but decentralized execution that was not in place during both the Korean and Vietnam Wars. The development of these doctrines was slow and often inefficient because of the difficulties related to positive control due to communication issues and the different Standing Operating Procedures (SOPs) of each of the Services.[17]

The Goldwater-Nichols Defense Reorganization Act of 1986 brought the necessary changes required for the development of a better doctrine in order to address the deficiencies

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[15] From AFDD2, 3 April 2007: When multinational operations are involved, the JFACC may become a "combined force air and space component commander" (CFACC). Likewise, the air and space operations center (AOC), though commonly referred to as an AOC, in joint or combined operations is correctly known as a joint AOC (JAOC) or combined AOC (CAOC).

[16] *Ibid*, pg 1

[17] *Ibid*, pg 1

identified in Korea and Vietnam for future operations. "As Dr Stephen Frought indicates, the Act 'Gave the Joint Chiefs of Staff responsibility to develop joint doctrine' and 'gave [combatant] commanders authority to resolve issues involving unity of command."[18] In response to the Act, the US military moved to a component based operational structure to address unity of command and effort which in part saw the creation of the Joint Force Air Component Commander (JFACC[19]).[20]

2.3 – DEVELOPMENT OF INFORMATION DIGITALIZATION AFTER THE COLD WAR

"While the Goldwater-Nichols Act set the US Armed Services on the long and often difficult road to 'jointness' it did not address the wider implications of coalition operations."[21] Following the end of the Cold War in 1989 and the collapse of the USSR that followed, most countries forming NATO quickly realized that doctrine and procedures developed during the Cold War would need to be adjusted in order to address the new threat environment. "The 1991 Gulf War, designated Operations Desert Shield (force build-up operations) and Desert Storm (combat operations), was an early trial of the evolving

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[18] *The Tale of the C/JFACC – A Long and Winding Road* by Dr Stephen O Fought (Air and Space Power Journal – 22 Dec 04 – Page 5).

[19] As defined in Joint Publication 1-02 1, the JFACC is: "The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for making recommendations on the proper employment of assigned, attached, and/or made available for tasking air forces; planning and coordinating air operations; or accomplishing such operational missions as may be assigned. The joint force air component commander is given the authority necessary to accomplish missions and tasks assigned by the establishing commander."

[20] Griffith, David. Coalition airspace management and deconfliction. *11th International Command and Control Research and Technology Symposium: Coalition Command and Control in a Networked Era*. 6 June 2006, pg 1.

[21] *Ibid*, pg 2

operational formations."[22] Within the coalition, the new air component concept proved efficient; however significant weaknesses were identified. Those can be summarized by the problems within collaborative planning and the execution of the operations. The situation was further hindered by improper communications. Finally, and more importantly, the coalition's information systems proved to have an extremely limited ability to operate inter-system.[23] "Failures in airspace management resulted in 11 of the US military's 35 'friendly fire' casualties, which equates to 7.5% of total combat deaths."[24]

"The need to refocus military operations in the post-Cold War environment was also recognized by the UK."[25] The British Armed Services, specifically the Air Force (RAF), realized after the Falkland Conflict, NATO operations in the Balkans and during Operation DESERT STORM in the Gulf that their Cold War structure in place did not support a Joint operation efficiently. As a result, the British shifted their operational focus towards an expeditionary footing: "This restructuring saw the formation of the Permanent Joint Headquarters and the adoption of the component command concept already in place within the US military."[26] The RAF created a standing cadre whose mission was to provide the core staff for a deployable Joint Force Air Component Headquarters (JFACHQ). This headquarters was responsible for the planning and execution of air operations, both at the

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[22] *Ibid*, pg 2

[23] *Ibid*, pg 2

[24] *Gulf War's Friendly Fire Tally Triples* by Barton Gellman (Washington Post, 14 August 1991).

[25] Griffith, David. Coalition airspace management and deconfliction. *11th International Command and Control Research and Technology Symposium: Coalition Command and Control in a Networked Era*. 6 June 2006, pg 1.

[26] *Gulf War's Friendly Fire Tally Triples* by Barton Gellman (Washington Post, 14 August 1991).

joint and coalition level. Unfortunately, while the new doctrine and procedures were maturing, too many of the lessons identified during Desert Storm related to battlespace coordination were not followed; the Kosovo operations revealed yet again significant weaknesses in airspace management and operations.[27]

These procedures were once again responsible for poor coordination of assets especially at the start of Operation Iraq Freedom in 2003. These problems or difficulties in coordinating a multitude of different platforms in very little battlespace were mainly caused by the introduction of new technologies not yet well integrated and using different communication systems. "Problems in the dissemination of airspace information, compounded again by battle tempo, once again resulted in blue-on-blue incident that caused 13 of the 71 US deaths during combat operations."[28] The repeated engagement by Ground Based Air Defence (GBAD), Tactical Ballistic Missiles (TBMs) and armed Unmanned Aerial Vehicles (UAVs) through a very busy airspace proved that the theory of big sky, small bullets was not true anymore in this congested environment. "Aircraft were also involved in fratricide incident including an F-15E Eagle whose pilot mistakenly bombed a convoy of US Special Operations Forces and Kurdish allies and a Marine AH-1 Cobra helicopter that shot and disabled an M1-A1 Abrams tank."[29]

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[27] Griffith, David. Coalition airspace management and deconfliction. *11th International Command and Control Research and Technology Symposium: Coalition Command and Control in a Networked Era*. 6 June 2006, pg 2-3.

[28] *Gulf War II - The Road to Victory* by Adam J. Hebert (Air Force Magazine - May 2003 Vol. 86, No. 5).

[29] Stopping Blue-on-Blue - How the U.S. military is trying to eliminate the age-old problem of friendly-fire deaths by Christian Lowe (Weekly Standard – 8 September 2003).

These serious incidents were also more difficult to avoid because of the coalition environment. Different procedures and communication suites were impeding effective operations by causing coordinating difficulties. The former Commander of US Central Command, General T.R. Franks, testified before the Senate Armed Services Committee that during Operation Iraq Freedom: "*coalition information sharing must be improved at all levels*".[30]

Over the past decade, the CF has recognized the need to acquire an integrated command and control (C2) capability suitable for unified command of forces conducting joint operations. During that time, the importance of tactical data networks in achieving that goal has become clear with network-enabled operations (NEOps) forming a central part of that objective. A significant component of the CF efforts to become network-enabled has been the integration of new tactical data links (TDLs), specifically Link 16, into its operations. The focus on this capability was intensified when the CF identified a joint Canadian Link 16 network as a requirement to fulfill their mandate to provide aerospace and maritime security for the 2010 Winter Olympics in Vancouver under Operation Podium. Due to the transformational nature of Link 16 technology, the Department of National Defence (DND) and the CF have faced significant challenges while implementing this capability in support of recent high-profile domestic missions, and face yet more formidable challenges in realizing their true value in the service of Canada.

[30] Statement of General Tommy R. Franks, former Commander US Central Command before the Senate Armed Services Committee 9 July 2003.

Firstly, since it first sent Link 16-enabled destroyers on operations following the events of September 2001 with US naval groups, Canada's navy had defined the tasks and training necessary to run a Link 16 network, and assigned them to the Naval Combat Information Operators (NCI OPs), establishing Link 16 training and equipment testing facilities on both coasts with Multi-Unit Link Testing and Operational Training Systems (MULTOTS) – East and West. Secondly, the air force received in 2007 the first of 80 upgraded CF-18s with Multifunction Information Distribution System (MIDS) model 1 Low Volume Terminals (LVT 1). The MIDS miniracks (employing the same terminal on the ground) at 12 and 42 Radar Squadrons now enabled both squadrons to support TDL operations in Bagotville and Cold Lake respectively. The air force also plans to acquire and put MIDS terminals on CP140 Auroras. An air force concept of operations for data links and a job task analysis and training need assessment have both been signed off and put to use, in isolation. Finally, the army fielded five mobile Air Space Coordination Centres (ASCCs) [31] housed in Bison 8-wheeled vehicles. Those are able to participate in Links 16 and 11B as well as Joint Range Extension Applications Protocol (JREAP) by phone, satellite and Internet Protocol (IP). The army has also procured Enhanced Position Location Reporting System (EPLRS) radios for a specialized land TDL capability and successfully trialed the provision of friendly ground locations from EPLRS onto Link 16 through an air defence system integrator (ADSI).[32]

[31] The ASCC is the facility into which the various airspace users provide inputs concerning their requirements, where conflicts between users are resolved, and requirements are consolidated and forwarded to HIGHER for approval. In essence, the ASCC determines how the commander's airspace requirements can best be satisfied by maximizing the effective safe use of the airspace with minimum restrictions. This allows the flexibility of airspace use in an efficient, integrated and flexible manner, and provides a commander with the operational flexibility to effectively employ forces in times of conflict. From: http://www.army.forces.gc.ca/4air_def_regt/equipment.html

[32] ADSI – Air Defence Systems Integrator. The ADSI is a real time tactical command and control system that receives, forwards, and displays tactical information. It can have up to 16 Tactical Data Links (TADIL) that

Perhaps the most significant and coordinating support to Canadian TDL capability development came from the Assistant Deputy Minister of National Defence for Information Management (ADM(IM)), which established a Joint TDL Management Cell (JTDLMC) under the interim leadership of a NCI Ops CPO2[33] with the title Canadian TDL Coordinator in preparation for OP PODIUM in September 2008. Directorate of Land Requirements (DLR) is also studying a project which would see the acquisition and integration of Blue Force trackers(BFT) thus greatly enhancing the coordination of the battlespace and avoidance of fratricide by tracking the position of friendly forces using Link 16 communication systems.[34] BFTs are systems that represent however some challenges in order to be used by a field forces as mentioned by Major Austin. These challenges are: Interoperability, multi-level security, signal coverage, bandwidth, and force planning.[35] "However, they do not confirm the force in question *is indeed* an enemy just because there is no friendly indication on a BFT display. Operators and commanders must still accomplish positive enemy identification."[36]

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communicate with systems like the Patriot, AWACS, ships, Command centers, and radars. From: http://www.army.forces.gc.ca/4air_def_regt/equipment.html

[33] Joint Tactical Data Link Management Cell (JTDLMC). Brief to Data Link Advisory Panel 44, Moncton, 30 Sep 2008. (Cdn TDL Coord). http://img-ggi.mil.ca/stratctr/commitboards/dlap/44moncton_e.asp

[34] The necessity of the initiative was well conveyed by Admiral (US Navy) Cebrowski, who stated "If you are not Link 16 capable you will not be welcomed on the US battlefield and in fact you will be considered a blue on blue engagement generator, a threat to friendly and coalition forces."

[35] D.G. Austin, Blue Force Tracking: Considerations for the Operational Commander. Air Command and Staff College, Maxwell AFB, April 2006, p.1.

[36] *Ibid*, pg 13

Within the establishment of JTDLMC, steps were taken to correct the following issues: development of the way ahead for joint training opportunities such as OP SILVER and GOLD (training exercises leading to OP PODIUM), development of TTPs and certification process for the courses described at appendix 1, and the structure forming the cell. So it translated by standing up a permanent network design capability, which aimed to "support future enabled operations and the training necessary to generate personnel capable of serving in future operational JICCs."[37] Further, it was felt that joint training was necessary. It translated into a series of courses[38] being conducted in Moncton and Vancouver in order to train technicians and JICOs in preparation for OP PODIUM and post operations. As well, an appropriate governance and authority structure over the cell was established in order to consolidate all the equipment and personal into one common structure to ensure the success of TDL functionality. Finally, network management systems were purchased such as software to facilitate the coordination of the airspace and to facilitate the integration of data into the COP.[39]

2.4 – SUMMARY

[37] A.E. Turnbull, *Directorate of Air Staff Operational Research*, Tactical Data Links Study**,** DRDC CORA TM 2010-034, March 2010, p.4.

[38] JT101: provides instruction in joint operational procedures and capabilities of Link 16 equipped systems, JT102: provides instruction on Joint C2 organizational structures and joint/coalition planning considerations, along with Joint Tactical Air Operations (JTAO) interface management fundamentals, JT201: provides instruction in advanced Link 16 concepts, Joint Tactical Information Distribution System (JTIDS) / Multifunctional Information Distribution System (MIDS) capabilities and how they relate to planning, and JT301: provides joint training to service personnel who will be tasked with the responsibility for planning, designing, and managing the Joint Multi-TDL Networks (MTN) as a JICO, Joint Track Data Coordinator, and/or TDL Manager.

[39] *Ibid*, pg 4

Tactical data links are not new to the CF. Since the early 1980s, the Canadian navy has employed Link 11 communications between shore locations, destroyers, frigates, and supporting aircraft (currently Sea King helicopters and Aurora long range patrol aircraft). However, the Canadian navy was moved to outfit deploying destroyers with Link 16 not only by the enhanced capabilities it offered, but more immediately by the sudden shift in operational focus after 9-11, Canada's desire to participate with the United States (US) in naval operations in the second Persian Gulf war, and the extent of US military reliance on Link 16 as the backbone of joint C2, so that a meaningful role in those operations was impossible without it as proved by the difficulties encountered both in Iraq and Afghanistan.[40]

Air/Land Integration (ALI) consists of three key elements: Strong relationships, knowledge of the capabilities and limitations, and the understanding of the doctrine and joint training.[41] "The net result of these three elements is true ALI, and underpinning this is the requirement to invest both resource and personal commitment. The effective delivery of ALI is a people-based challenge, with leadership and commitment being the key factors."[42] These challenges were present in both theatres in the validation of coalition training, coordination of Air power and C2 architecture, and the increased demand for Intelligence Surveillance Target Acquisition and Reconnaissance (ISTAR) and Close Air Support (CAS) that routinely outstrips availability of assets. The emphasis needed at the operational level for more

[40] J.A. Steele, *Directorate of Air Staff Operational Research*, Tactical Data Links capability development Study**,** DRDC 3554-1 (H/Air Section), 13 August 2010, p. 2.

[41] Air Chief Marshal Sir Clive Loader, Is true Air/Land Integration Achievable. Rusi Defence Systems, February 2009, p.50.

[42] *Ibid*, pg 51

integration and “at the strategic level…a more coherent approach to the procurement of equipment coupled, inevitably, with the future development of the capabilities involved.”[43]

> *“We, as single Services, need to align our aspiration, setting aside some of our historical prejudices need and beliefs, and commit ourselves truly to support joint goals, and we need to take a coherent approach to maximising the potential synergy that exists between us. The senior leaders across MoD need to speak with one voice and push ALI until it permeates every level of the process from strategic to tactical…forces elements are likely to be increasingly dispersed, thereby placing ever greater emphasis on coordinated ISTAR and integrated fires/effects.”*[44]
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> *- Commander-in-chief, UK Air Command. Sir Clive Loader*

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[43] *Ibid*, pg 52

[44] *Ibid*, pg 52

CHAPTER THREE

NOW AND THE FUTURE

3.1 - INTRODUCTION

The previous chapter discussed the CF historical background regarding tactical data links. It showed the difficulties in the current structure to work in an integrated manner with both the CF components, and the other members of NATO. The extent of US military reliance on Link 16 as the backbone of joint C2, forces potential partners to employ the same, but it has proven difficult to join their networks as demonstrated by coalition experiences in Iraq and Afghanistan. ALI, to be achieved is based on three essential elements, which are: Strong relationships, knowledge of the capabilities and limitations, and the understanding of the doctrine and joint training. To achieve true ALI the CF needs to invest both in resources and personnel. It was also indentified that the effective delivery of ALI is people-based challenge, needing leadership and commitment. A comprehensive approach to nurture integration will need to be coherent in the procurement of equipment and in its vision for future employment.

This chapter will present case studies to confirm the concepts developed in chapter two, and indentify barriers to the improvement, and their influences. It will show that Canada's current state of tactical data link capability is challenged by limited human resources; and that a lack of career stream specialisation prevents building an effective foundation and perpetuate a culture of continuous improvement. Despite these restrictions, Canada has invested in contracted training known within the Canadian Forces as "out-service training”. This training refers to all Link courses that are given by private companies such as Boeing, Raytheon and Ultra avionics.[45]

Canada’s lack of a definite and comprehensive approach to developing a standardized system has been criticized in the past. The acquisition of equipment in a “stove-pipe” manner has contributed to a certain extent to this situation. But is it possible that the issue stems also from the lack of a joint, or standardized doctrine and leadership challenges? In reality Allies have suffered similar difficulties. However, there is a desire from their part to share training standards as well as resources, in order to provide a more robust tactical data link capability. Perhaps a more effective approach to current tactical data link training can be achieved through distributed learning standards. To date, the correlation between the requirement to train effectively and the use of distributed learning in training has not been studied in detail.

Indeed the work to plan and implement distributive learning is relatively new; some work has been done, but very few studies have been completed. The need for convergence was described by Smith (2006) as “a different aspect of the *how to*…[that] revolves about creating the organizational, institutional, and force capability underpinnings that enable the kind of agile adaptable effects-based operations that commanders and a political leadership need to succeed”[46]

[45] Link16 Training package. NCS, dated Jan 2010. Pdf

[46] Neil F Doherty and Malcolm King. From technical to socio-technical change: tackling the human and organizational aspects of systems development projects. *European Journal of Information Systems* (2005) 14, p.1.

3.2 - DEFINING THE PROBLEM

One of the most important aspects of the barriers to the implementation of the JTDL capability resides with the pressures caused by systems development. These pressures related to IT projects and their analysis will be done using the case studies of Chae & Poole (2005), Lin & Silva (2005), Luna & Reyes et al (2005), and Iannacci (2010). The detailed analysis of these case studies will be used in order to formulate key recommendations on how to best use the identified constraints of systems development for the best integration of JTDL for the Canadian forces. While it is acknowledged that the human and structural dimensions play an important role in systems development, the progress of practical social-technical methods and approaches is moving very slowly in order to form a common usage within major organizations. As Clegg (2000) notes, "socio-technical principles and practices have not had the impact that their proponents might wish."[47]

Three points are emphasised by Doherty and King. The first one was that the rates of failure for new systems are very high. The second was in regard to predicting and properly managing the impacts of the implementation of IT investments that are the primary cause of this failure. These impacts can take several forms and will be described in detail through the analysis of the four case studies, which will affect the implementation in diverse ways. The last points discussed the difficulties in addressing the human and organizational dimension during the phase of development of new systems. This issue is considered as well as part of

[47] *Ibid*, pg 2

the identified failure. All of the case studies will shed some light on the condition and the reasons for this failure.

3.3 - DETAILED ANALYSIS

FIRST CASE STUDY:

The first case study from Chae and Poole "develops the argument that pre-existing information systems are active forces in systems development."[48] It is by the study of the efficiency of a system that better ones can be developed. This means that information systems that exist and are used will, or should be, an intricate aspect of the development of a new structure. It is always very difficult to start from scratch, as new systems will come with entirely new maintenance and training regimen. Logically it is better to analyze the performance of existing systems, find their faults and see how these faults or problems can be solved incrementally instead of bringing completely new systems. However, it is also possible to replace a system by an entirely new one; this would normally occur if the older system does not have the potential to improve or that the technology is so new that this system is obsolete to the point of hindrance. They also develop a framework integrating the different elements forming theories in regard to structures and actor networks to provide a complete analysis on "how information technologies and institutional features interact in the structuring of information systems."[49] Material constraints and directions from previous development influence the shaping of new system. In addition, the case study attempts to

[48] Bongsug Chae and Marshall Poole. The surface of emergence in systems development: agency, institutions, and large-scale information systems. *European Journal of Information Systems* (2005) 14, pg. 19.

[49] *Ibid,* pg 19

identify the interaction or lack there of, between different components, such as existing practices, culture, technologies, and other socio-technical elements (cf. Gosain, 2004); or disciplinary, and human agency in IS development.

The next topic focuses on the theoretical foundations forming a framework "that captures the multiple roles of material and human agents in the development process."[50] The Theoretical foundations are the varieties of agency and the constitution of the surface of emergence in IS development. They are providing the core ideas of what will influence the development process. This framework also allows the linkage of the elements of Giddens (1984) theory of structuration, which holds that all human action is performed within the context of a pre-existing social structure which is governed by a set of norms and/or laws which are distinct from those of other social structures. It also refers to the actor-network theory "that opens up the black box of pre-existing systems and shows how institutional features influenced system development."[51] Interactions between actors within an institution needs to be studied, to allows developing a picture of what network will influence most the development of the system. The influence of many scholars in the domain of IS such as Kling, Kreamer, Laudon, Iacono, Scacchi and King through the conduct of many studies in the mid-1980's is still very present and pertinent today as why the social and political processes are paramount in preserving existing organizational and social structures. These concepts pertain mostly on the human-interaction within a development system. It identifies the influence and interaction of both people and institution when confronted to changes. This

[50] *Ibid*, pg 20

[51] *Ibid*, pg 20

may be a barrier of extreme importance in the subject of this research and will be analyzed further.

The case study methodology uses the development of the University Management Information System (USMIS) in the context of nine universities and eight state research and extension agencies in order to collect the data consisting of archival records, personal notes kept by participants, and interviews. All of the information collected was used in order to identify elements forming the main structure of developmental systems and their pre-existing IS and to find how they shaped USMIS development. Some emergent aspect, or element creating a surface of emergence which permits identifying core issues related to USMIS then helping in qualifying how heavy, or strong their influence was on the IS development process. Therefore, the identification of strengths and weaknesses in pre-existing elements allowed to see where the efforts needed to be prioritized. Existing elements that could be employed as instrument of analysis could be such aspects as the informal culture developed over time while using the system; analysis of the experience related to previous system development, of the technical and organizational knowledge acquired over time while employing the system, and of its hardware, software and programming languages. The strengths of the influence on IS can be summarize by their material and embedded components and the weaknesses by their disciplinary and human components.[52]

The authors concluded that "there is a strong tendency in the systems development literature to focus primarily on the system under development and to underemphasize the role

[52] *Ibid*, pg 29

of pre-existing information systems."[53] This basically means that the focus is often aimed too much at the conception of a new system without taking into consideration the pre-existing ones, and the spiraling effects a new system will have on all of the peripheral elements such as informal culture, etc. This case study using USMIS also illustrates the importance of using pre-existing systems in the development of a new system recognizing the material constraints and learning from the experiences of the old system. Looking back to the development of the JTDL system, the following deduction can be drawn from this case study: Technology development is not the major problem; technology can be generated by scientists and technicians, yet the capabilities are often not meeting the demands due to a poor integration with current information systems.

SECOND CASE STUDY:

The second case study from Lin and Silva develops the argument that "users' cognitive frames should be a key factor in managing the adoption of information systems."[54] More specifically, they argue that the beliefs and the perceptions of the stakeholders as well as users are greatly influenced by the aspects of social and political processes: "The work demonstrates that the management of information systems adoption is a social and political process in which stakeholders frame and reframe their perceptions of an IS (Orlikowski, 1992; Walsham, 1996)."[55] The case study presented is examines an International Bank based

[53] *Ibid,* pg 34

[54] Angela Lin and Leiser Silva. The social and political construction of technological frames. *European Journal of Information Systems* (2005) 14, p. 49.

[55] *Ibid,* pg 49

in Switzerland and their intent of replacing their aging e-mail system under a modernization project named GroupWork .

The research framework is centered on the fact that a serious problem of understanding exists between the systems users and the analysts originated from the lack of a shared frame between both parties as described to Boland (1978). This problem is at the root of the difficulties in developing a new system. "Lyytinen and Hirschheim (1987) argue that 'failure is the embodiment of a perceived situation' rather than actual failure' itself."[56] This means that once an issue has been perceived, noted or considered as a failure, it may be very difficult to change that perception, and efforts will be spent on the wrong aspect of a problem. They also add that the technological frame is influenced by individual perceptions of how the system should work their own understanding of the technology and their interpretations on how to use it. These "bias" will drive the way research will be undertaken, to solve what is perceived as the problem, and ultimately may disguise the root cause. At worst, the development may become entirely non-productive and cause serious cleavage between developers and users.

The case study methodology uses the switch of the Bank computer operating system from DOS-based Higgins to Window-based applications in the context of their Office Information Systems (OIS) forming the different user departments in order to collect the data. The information collected was used to identify the perceived issues identified by three different groups of individuals: The management, the project team, and the user group. The

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[56] *Ibid*, pg 50

management group consisted of the senior managers responsible for the purchase of the new system and to ensure that the best technology based on cost benefits was obtained. The project team consisted of the IT technicians from the OIS department responsible for the identification of potential problems related to the new system and how to solve them. The user group consisted of different bank representatives responsible to identify the compatibility and the usefulness of the new system.[57]

Their analysis brought some shared technological frames, understandings of the problem and recommendations for a new platform for each of the group. For the management group, these recommendations included implementation of software that could be used by the group of people working on the same information, but may be distributed in space: groupware. This groupware needed to be capable of meeting both of the business and the technical needs, to minimize the cost for implementation and thus improving operational benefits. The project team focused on finding a replacement that was supportable technically, aiming to replace Higgins by a system compatible with the other bank systems; and finally to minimize user complaints with a new e-mail system. Finally, the user group, based on previous experience with Higgings, aimed to replace it with a more user friendly system, which would improve performance. [58]

After their analysis, the authors concluded to three propositions to explain how a system is influenced by perspective, and more importantly by the relative influence each

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[57] *Ibid,* pg 52

[58] *Ibid,* pg 55

group sharing a different perspective will have on the other ones. The first proposition is that the context under which a system is evaluated will influence the perceptions of the capacity of a given system. It's, for example, in studying a virus to find an appropriate remedy, which microscope will be used and how the issue will be studied. The second is that "successful implementation of an information system will be facilitated by achieving congruent technological frames."[59] Technology frames are "that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations. This includes not only the nature and role of the technology itself, but the specific conditions, applications and consequences of that technology in particular contexts."[60] Its which slides, in what order, will be put under the microscope to gather and analyze the information. The last proposition is that the "understandings, interpretations, and expectations of information systems are framed and reframed through the exercise of power."[61] Basically, it's who will focus the microscope, on what and how. The authors mean that during the developmental process, the perspectives of the strongest group, in this case the management group, will heavily influence the way the development will occur, at the detriment of either of the other groups' perspectives and perhaps their needs. They concluded that as much as an appropriate microscope, with the relevant slides to examine and the proper focus will allow results, "social phenomena such as language, symbolic power, and communication processes are fundamental for understanding how technological interpretations are framed."[62]

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[59] *Ibid*, pg 55

[60] From: http://www.jstor.org/stable/pdfplus/4132312.pdf?acceptTC=true. Accessed on 29 May 2011.

[61] *Ibid*, pg 57-58

[62] *Ibid*, pg 58

THIRD CASE STUDY:

The third case study from Luna and Reyes develops the argument that "many information systems development (ISD) initiatives fail to deliver the expected benefits."[63] More specifically, they argue that the technical failures are not the only factors to be considered when analyzing the effects and the causes of successes and failures related to new IS. "Risks of failure increase in distributed systems where no participant has a global view or control of their activities (Star, 1998; Tsoukas, 1996)."[64] The case study presented is using the Multi-purpose Access for Customer Relations and Operational Support (MACROS) used by a New York state agency conceived for the coordination of their different departments.

The research framework is the development of a practice view of socio-technical change, meaning the social aspects of people and society and technical aspects of organizational structure and processes. Here, technical does not imply technology. "Technical" was a term used in those times to refer to structure and a broader sense of technicalities. Socio-technical refers to the interrelatedness of *social* and *technical* aspects of an organization.[65] This results in a comprehensive analysis approach: "the approach what

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[63] Luis F. Luna-Reyes, Jing Zhang, J. Ramo´n Gil-Garcı´a and Anthony M. Cresswell. Information systems development as emergent socio-technical change: a practice approach. *European Journal of Information Systems* (2005) 14, p. 93.

[64] *Ibid*, pg 93

[65] *Ibid*, pg 93

Orlikowski & Iacono (2001) identify as the 'ensemble view' of technology."[66] For them, this socio-technical view included not only hardware and software but lots of different factors such as people, processes, institutional and cultural behaviours. "Each perspective provides some insight into the dynamic interaction among social structures and information technologies."[67] This meet the perspective described in the second case study in the sense that again the needs, expectations and perspectives of each groups related to the systems' development will influx on this one. The practice-oriented approach to ISD also includes technological design, distributed computing and the sociology of science and is relevant to the socio-technical views. In a way, the socio-technical view, or the way the society's perception of the technologies' needs is conceived, will directly, in a holistic manner, influence the design of the said technology and research associated with it.

The case study methodology uses the MACROS project that was used in order to enhance the communication network and services of the Municipal Affairs (MA) to local offices, "as well as to facilitate information flow between central and regional offices of MA (OSC-MA, 1998)."[68] Four main elements formed the research method: Organization, practice, requirements, and functionality. The process model for MACROS development was analysed using a series of episodes (8)[69] and encounters (8) related to each episode.

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[66] *Ibid,* pg 94

[67] *Ibid,* pg 94

[68] *Ibid,* pg 97

[69] Episodes are: Gathering system requirements, obtaining support and spreading the MACROS concept, contrasting MACROS concept with regional work practices and obtaining resources, negotiating with BITS and other divisions, preparing for cross-divisional system requirements, implementing system functionality – customer contact list, rolling out the system and initial expansion of MACROS, and defining requirements and adding functionality for technical assistance.

These episodes led to many changes and challenges within the Office of the State Controller (OSC) such as case presentation, rejection of resource request, change of system requirements and an augmentation of technical assistance. This lead to the adaptation of the new operating applications put forward by MACROS. "The impact of MACROS has gone beyond a basic information system, to enhance knowledge sharing, collaboration, and information systems investment across the organization."[70]

By correlating the data using semi-structured interviews and non-participant observation, the authors identified four accumulations, helping to understand the process of ISD: "organizational design, knowledge about practice, system requirements, and system functionality. Moreover, our analysis focused mainly in the social processes without taking into account the specific role of artifacts in shaping practices and other social processes."[71] Once again in the context of the development of the JTDL system, the four accumulations identified by this case study may be relevant to the development of this capability especially the importance of the system requirements and their functionality in a joint environment. Further, would it be possible to correlate these to the influence of perceptions identified during the second case-study? This would allow the integration of a comprehensive approach to define the developmental needs of a system. Within the Canadian Forces, competing issues regarding the responsibility for training have emerged. Obviously, some aspects of tactical data link training do require service-specific oversight on such content as service

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[70] *Ibid*, pg 100

[71] *Ibid*, pg 104

operating procedures, equipment, and standards, whereas other more generic processes, such as theory, policy, and interoperability, require joint oversight.

FOURTH CASE STUDY:

The fourth and last case study from Iannacci focuses on highlighting the links that exist between data standards and institutional facts. "When the institutional context has been taken into account (Chae & Poole, 2005), extant approaches to information infrastructures have appeared devoid of the institutional arrangements and cognitive imageries , or the perspectives of the problem which is influenced by the institution vice the real problem that inform designers in the process of developing large-scale IS."[72] Ciborra and Lanzara (1994) also related to these conditions such as the relationship between technology and organizations, the transaction cost theory and IS infrastructures and added that they create the background condition for action and sense making. In other words, it allows seeing the problem through the appropriate lenses by identifying what needs to be done, choosing the right information to be analyzed, in order to achieve the desired effect by appropriate action taking. The case study presented examines the IS of the criminal justice system in England and Wales and argues "that the institutional facts play a pivotal role in the evolution of the underlying electronic messaging system that supports police-crown prosecutor interactions."[73] The purpose of the case study is to understand how the conditions and standards influence the social context within the information infrastructures.

[72] Federico Iannacci. When is an information infrastructure? Investigating the emergence of public sector information infrastructures. *European Journal of Information Systems* (2010) 19, p. 35.

[73] *Ibid*, pg 36

"Information infrastructures involve the development of classification systems that stretch beyond technological platforms to include users' communication behaviours and taken-for-granted practices (Bowker & Star, 1999; Bowker, 2005)."[74] Ciborra's (2000) added that the use of a case study such as this one can help to understand how ad-hoc information structures influences IS development. Chae and Poole (2005) bring the notion that "the role of institutional facts with regard to the design of new standards and logical messages as, in attempting to develop new IS, designers arguably draw on the institutional aspects of pre-existing systems."[75] For example, identifying the importance of using pre-existing systems in the development of a new system recognizing the material constraints and learning from the experiences of the old system as identified in the first case study.[76]

The case study methodology uses the AGIS programme that ran from 2003 to 2007 in order to establish a single framework program for all of the candidate countries (Denmark, England and Wales, Finland, France, Italy and the Netherlands) in the areas of justice and home affairs.[77] The aim was "to set-up Europe-wide networks, as well as to exchange information and best practices, thus enhancing cooperation in criminal matters and in the

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[74] *Ibid*, pg 37

[75] *Ibid*, pg 37

[76] Bongsug Chae and Marshall Poole. The surface of emergence in systems development: agency, institutions, and large-scale information systems. *European Journal of Information Systems* (2005) 14, pg. 19.

[77] Framework programme concerning police and judicial cooperation in criminal matters (AGIS). http://europa.eu/legislation_summaries/justice_freedom_security/police_customs_cooperation/l33177_en.htm

fight against crime."[78] The system that allowed exchange of electronic case files between these countries is the Criminal Justice System Exchange (CJSE). This system messaging network integrates many other systems such as the National Strategy for Police Information Systems (NSPIS), the Case management System (CMS), and the Police National Computer (PNC) systems.

Iannacci concluded "that besides the technical level of software, information infrastructures should first and foremost be conceived at the social level of institutions."[79] He also used Boland & Tensaki (1995) argument that the design of electronic systems and the information infrastructures should always be done within the context of the aim of the organization. Chae and Poole (2005) case study is used by Iannacci in order to reiterate the importance in any system development process of the interaction between the notions of material, disciplinary and embedded human agency. His last point is that "digitisation and informatisation of tasks, operations and domains of activity, leading to the dissolvability and decomposability of human work in organizations, and, at the extreme, to the 'pulverization' of what we assume to be material reality (Kallinikos, 2006)."[80] This illustrates the dangers that information and communication technologies mediate a coherent set of principles for framing and acting upon reality. "The social and behavioral implications of such principles

[78] Federico Iannacci. When is an information infrastructure? Investigating the emergence of public sector information infrastructures. *European Journal of Information Systems* (2010) 19, p. 38.

[79] *Ibid*, pg 46

[80] *Ibid*, pg 47

transcend the human-technology interface and cannot be sufficiently studied as an instance of local adaptation and interpretation of technological systems and artifacts by willful agents."[81]

3.4 - MAJOR FINDINGS

From the first case study, Chae and Poole draw the following conclusion: There is a strong tendency in the systems development literature to focus primarily on the system under development and to underemphasize the role of pre-existing information systems. It also sheds some light on the importance of using pre-existing systems in the development of new ones recognizing the material constraints and learning from the experiences of the old system. These points in the context of the development of the JTDL system lead us to believe that technology development is not the major problem but the role of pre-existing IS related to this function needs to be taken very seriously. This means that other aspect than technical issues will affect the system development, such as perception, social phenomena such as language, symbolic power, and communication processes, poor integration with current information systems, organizational design, knowledge about practice, system requirements, and the human-technology interface.

From the second case study, Lin and Silva put forward three propositions from the results of this analysis. The first proposition is that the context under which a system is evaluated is important and influences the perceptions of the capacity of this system. The second is that the implementation of an information system will be facilitated by achieving

[81] http://en.wikipedia.org/wiki/Jannis_Kallinikos

congruent technological frames. The last proposition is that the exercise of power plays a major role in the framing of any information systems. This last proposition suggests that the balance of power may disadvantage the groups consisting of the project team and the users group for the considerations of the management group. They concluded that "social phenomena such as language, symbolic power, and communication processes are fundamental for understanding how technological interpretations are framed."[82] In a military context this will be a significant challenge as the organization is regimented and compartmentalized. For example, each component will acquire equipments according to their own perceived needs, as opposed to using a synchronized, comprehensive system. Further it is very much how much weight and priority will be given by the components on the issue at hand that will dictate their interactions as well as their agendas.

From the third case study, Luna and Reyes concluded by the identification of four accumulations that help to understand the process of Information System Development (ISD): These four accumulations focuses on the organization itself, the need to know the specific purpose of the system, the requirements and the functionality of the system to be developed. Their analysis "focused mainly in the social processes without taking into account the specific role of artifacts in shaping practices and other social processes."[83] Against the context of the development of the JTDL system, the four accumulations identified by this case study may be relevant to the development of this capability especially

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[82] Angela Lin and Leiser Silva. The social and political construction of technological frames. *European Journal of Information Systems* (2005) 14, p. 58.

[83] Luis F. Luna-Reyes, Jing Zhang, J. Ramo´n Gil-Garcı´a and Anthony M. Cresswell. Information systems development as emergent socio-technical change: a practice approach. *European Journal of Information Systems* (2005) 14, p. 104.

the importance of the system requirements and their functionality in a joint environment, by enabling to create specific area of research, establishing a commonality of language and needs by correlating aspects between each stakeholders.

3.5 – SUMMARY

The Canadian Forces has evolved significant formal agreements with other militaries, including NATO, ASIC, and bi-national agreements, such as North American Air Defence (NORAD). These agreements all involve sharing various training standards, materials, equipment, and, in some cases, instructors. Certain military online training is shared between Canada and the United States, but the sharing of tactical data link related training standards has yet to be achieved. Interoperability with the United States does not increase interoperability with all countries, and larger coalition agreements are seen as having increased value.

The Canadian Forces, as an organisation, is still attempting to adapt to the transformation in the United States resulting from the Goldwater-Nichols Act (1986), as previously discussed. The Canadian Forces has not fully transformed its infrastructure to support joint C2 and training. Many of the difficulties the Canadian Forces is experiencing in instituting effective tactical data link training are the lack of joint infrastructure to support it. But a joint C2 supported tactical data link may be considered a post-joint transformation capability that proves problematic to institute prior to transformation. In other words without the necessary joint infrastructure in place, adopting a capability that is designed to support joint operations is challenging.

The last case study by Iannacci brought also some pertinent conclusions that are relevant to the development of new information system such as JTTL. One of these conclusions is “that besides the technical level of software, information infrastructures should first and foremost be conceived at the social level of institutions.”[84] He also used Boland & Tensaki (1995) argument that the design of electronic systems and the information infrastructures should always be done within the context of the aim of the organization. His last point is that “digitalisation and informatisation of tasks, operations and domains of activity, leading to the dissolvability and decomposability of human work in organizations, and, at the extreme, to the ‘pulverization’ of what we assume to be material reality (Kallinikos, 2006). This will allow discussing the importance of having a centralized, focused lead agency, which will provide a vision, guide and control the developmental steps.

[84] Federico Iannacci. When is an information infrastructure? Investigating the emergence of public sector information infrastructures. *European Journal of Information Systems* (2010) 19, p. 46.

CHAPTER FOUR

THE BARRIERS

4.1 – INTRODUCTION

During OP PODIUM and CADENCE, TDL were utilized to integrate all link-equipped platforms into a single integrated picture. This single integrated picture refers to the integration of all available feeds each with there own subset of a COP into one using the ADSI. The common operating picture was available in the RCMP Integrated Security Unit, at CF headquarters throughout the Olympic Joint Operations Area, the Canadian Forces Integrated Command Centre (CFICC), the Joint task Force Pacific (JTFP), 1 Cdn Air Div HQ and at NORAD HQ resulting in a level of tactical situational awareness that was unprecedented in a Canadian domestic operation.[85] This awareness was unique as it was the first time that the Canadian forces were sharing successfully their picture with other government agencies. This was in contrast to a previous DOMOPS, OP GRIZZLY, where the interagency planning between the CF and the RCMP was identified as the major lesson learned requiring the greatest room for improvement.[86] Brigadier-general Fenton added: "Since we are usually in support of the RCMP… in matters of security, we need to insist on a unified command structure and location…Separate HQs unnecessarily complicates coordination, direction and control."[87]

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[85] MARPAC-#99360-v1A-BRIEFING_NOTE_-_TACTICAL_DATA_LINK_-WAY_FORWARD_(ACC_JTFG_RDIMS_99360), p.1.

[86] Col David Barr, The Kananaskis G8 Summit: A Case Study In Interagency Cooperation. Winter 2003 – 2004, Canadian Military Journal, p.43. http://www.journal.dnd.ca/vo4/no4/doc/operations-eng.pdf, accessed 14 May 2011.

[87] *Ibid*, pg. 44

The TDL successes, lessons learned and key conclusions resulting from OP PODIUM and CADENCE will be discussed later in this chapter. “Most importantly, they conclude that the CF has the necessary capabilities, both in personnel and equipment, to establish a joint TDL architecture to manage domestic operations 24/7 within Canada.”[88] However, this capability provides only part of the solution as it stands right now. Indeed, in order to provide this capability on a continuous basis, rather than simply for the duration of a specific operation, the CF systems would need, as demonstrated during OP PODIUM a complete integration of all existing systems under one agency in order to allow the coherent prosecution of all surface and air tracks. It needs to be acknowledged that this joint effort consists in the creation of one capability for a short period of time utilizing all available resources and leaving no equipment nor personnel to deploy a second operation during the same period. JTFG-ACC, Col Veenhof stated: “The equipment used to develop this capability was cobbled together from existing CF Link equipment belonging to all three services.”[89] This is obviously not a sustainable or necessarily easily repeatable capability within the CF.

4.2 - IDENTIFICATION OF THE PROBLEM

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[88] MARPAC-#99360-v1A-BRIEFING_NOTE_-_TACTICAL_DATA_LINK_-WAY_FORWARD_(ACC_JTFG_RDIMS_99360), p.1.

[89] *Ibid*, pg. 1

TDLs are standardized communication links for the transmission of bit-oriented digital information in a time sensitive and precise manner. The standards for their operations have been developed by the US Joint Chiefs of Staff and through international organizations like NATO and their release of ADatP-33: multi-link standard operating procedures for tactical data platforms employing all of the deployed Link feeds.[90] TDLs, and Link-16 in particular, are considered to be "critical enablers of joint combat capability." Joint Range Extension Application Protocol (JREAP) is an application of link 16 which gives TDL a beyond line-of-sight ability which is being used extensively in Canada.[91] Link 16 is considered as a critical enabler as it can integrate multiple Link networks as demonstrated by figure 4.1.

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[90] A.E. Turnbull, *Directorate of Air Staff Operational Research*, Tactical Data Links Study**,** DRDC CORA TM 2010-034, March 2010, p.16.

[91] J. Golliday, C. Leslie. Data link communications in tactical air command and control systems. IEEE Journal on Selected Areas in Communication, 3(5):779–791, 1985.

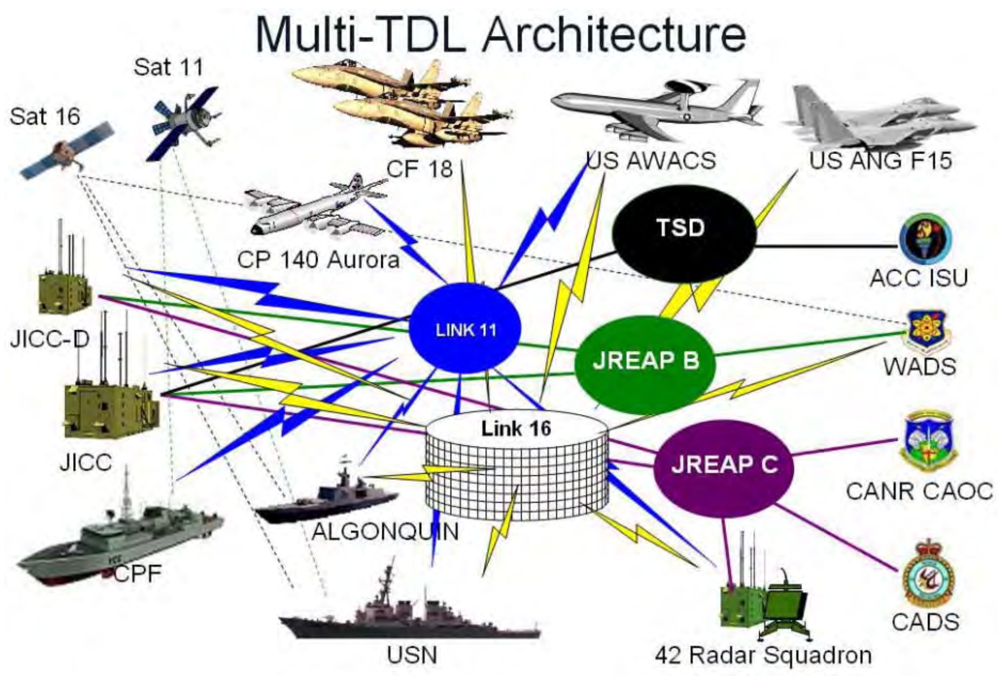

Figure 4.1 – Multi-TDL Architecture during OP PODIUM[92]

"An Operational Tasking Data Link (OPTASKLINK) defines all the settings and codes that the operators used to manage a single TDL network. Fundamentally, if a single integrated network is required, a single integrated OPTASKLINK is necessary."[93] Prior to OP PODIUM, key operational and tactical HQs such as MARPAC, CANR, Western Air Defense Sector (WADS), and the United States Coast Guard (USCG) all operated from separate and unique OPTASKLINKs and thus could not share their picture between each other. OP PODIUM was used to force the linkage of these disparate organisations and proved that it is possible and advantageous to operate on single National OPTASKLINK and with the proper coordination, do the same with the USA. However, post OP PODIUM and

[92] Dr. J.A. Steele, *Directorate of Air Staff Operational Research*, Tactical Data Links capability development Study**,** DRDC 3554-1 (H/Air Section), 13 August 2010, p.5.

[93] MARPAC-#99360-v1A-BRIEFING_NOTE_-_TACTICAL_DATA_LINK_-WAY_FORWARD_(ACC_JTFG_RDIMS_99360), p.2.

CADENCE, all have gone back to their stovepiped network management processes because of the current lack of permanent centralization.[94]

The JICC for OP PODIUM and OP CADENCE was manned by experts from the Army, Navy and Air Force, as directed by the TO&E.[95] All services have developed a great deal of expertise in the domain of procedures, check lists and problem solving tools, albeit, in some cases stove piped because adapted specifically for their own ECS. In terms of C2, JTFG followed the Canadian doctrine and gave management of the JICC to the ACC who was responsive to the LCC, MCC and NORAD/CANR. The ACC was supported by a Joint Data Networks Officer (JDNO)[96], again a doctrinal construct put forward by the Air Force before the Olympic and the G-8.[97] Regrettably, it can be argued that the other services had difficulties dealing with this doctrinal approach, as there is not Canadian common doctrine used between services other than some lessons learned, SOPs and after action reports. This doctrinal approach was not always fully understood by the other services as they don't use this integrated coordination function (MCC and LCC).[98] Given that the JICC was under the ACC, it was perceived as an Air Force capability. If left within a service, it risks becoming

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[94] *Ibid*, pg. 2

[95] *Ibid*, pg. 2

[96] Joint Data Network Officer. The JDNO coordinates with component commanders or command elements as directed by the Joint Force Commander (JFC). The JDNO is responsible to the JTF J-3 (Operations) with support from the J6, for Joint Data Network (JDN) operations and integration of information from the subordinate networks in support of the Common Tactical Picture (CTP). The JDNO is responsible to the JFC to provide an accurate, timely display of selected tactical data, supporting a JTF through the integration of JDN information.

[97] Air Force CONOPS for Data Link 3030-1, dated 05 Dec 2008 (A3 TDL Mgr), p.13.

[98] Dr. J.A. Steele, *Directorate of Air Staff Operational Research*, Tactical Data Links capability development Study**,** DRDC 3554-1 (H/Air Section), 13 August 2010, p.7.

stove piped and there will be natural tensions from the other elements supporting to accept it.[99]

Mitchell has noted: “The world is seized with the idea that we are at the doorstep of a new society…our thoughts today are guided by the vision of a future enabled by the power of digital technology.”[100] The emergence of digital technology is at the centre of some difficulties encountered in systems development and does significantly affect large institutions such as the Canadian Forces.

For Chae and Poole, the emergence of digital technology also supports the argument that pre-existing information systems serve as resources or constraints on development.[101] Doherty and King also support the argument that both the emergence of new technology and the importance of pre-existing systems impact all organizations by stating: “information technology has become a ubiquitous and increasingly significant part of the fabric of most organizations.”[102] Both authors may at first look seem to differ, but in reality, in their own way, they acknowledge that new technology will impact significantly IT development. However, this does not preclude that development cannot be achieved without using existing systems, which bring their own constraints. They add that technical changes are the catalyst

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[99] 3350-1 (RICO), Capt Mirosnikov, Adrian. Operation PODIUM post operation report – Joint Interface Control Cell – Deployed, dated 25 Mar 2010

[100] Einstein, as quoted by Paul T. Mitchell. Network Centric Warfare and Coalition Operations: The new military operating system. Routledge, 2009. Page 1

[101] Bongsug Chae and Marshall Poole. The surface of emergence in systems development: agency, institutions, and large-scale information systems. *European Journal of Information Systems* (2005) 14, pg 19.

[102] Neil F Doherty and Malcolm King. From technical to socio-technical change: tackling the human and organizational aspects of systems development projects. *European Journal of Information Systems* (2005) 14, pg 1.

for organizational change but can produce very different organizational impacts.[103] These impacts related to IT projects and their analysis will be further discuss later using of of these case studies. The first one will be from Chae & Poole on the surface of emergence in systems development. The social and political construction of technological frames described by Lin & Silva and the impacts of Systems development as emergent socio-technical change of Luna & Reyes et al will also be used in order to draw some conclusions. Finally, the case study of Iannacci on information infrastructure and the impact of the emergence of public sector information infrastructures.

"Existing systems have also been regarded as problems or barriers to the development of new IS and as disablers of IS-based organizational innovation and change (e.g. Markus, 1983)."[104] It can also be argued that key stakeholder groups within each ECS are also very protective by nature of their established procedures and reluctant to bring changes to structures already in-place. This protective posture is extended to their existing budget, personnel and equipment that are related to their existing systems and result often by a failure to involve users appropriately leading to an implementation that is not aligned with the organizational context (Poulymenakou & Holmes, 1996).[105] As Eason (2001) notes "organizational issues are tackled in an ad hoc way whenever they emerge, which is often after the system has been implemented."[106]

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[103] *Ibid*, pg 1

[104] Bongsug Chae and Marshall Poole. The surface of emergence in systems development: agency, institutions, and large-scale information systems. *European Journal of Information Systems* (2005) 14, pg 19.

[105] Neil F Doherty and Malcolm King. From technical to socio-technical change: tackling the human and organizational aspects of systems development projects. *European Journal of Information Systems* (2005) 14, pg 2.

While it is acknowledged that the human and structural dimensions play an important role in systems development, the progress of practical social-technical methods and approaches is moving very slowly in order to form a common usage within major organizations. As Clegg (2000) notes, “socio-technical principles and practices have not had the impact that their proponents might wish.”[107] Three points are emphasised by Doherty and King related to the literature on information systems: New system failure are very high, predicting and properly managing the impacts of the implementation of IT investments is the primary cause of this failure, and the lack of attention to the human and organizational aspects during systems development is also part of the failure.[108]

4.3 - CHALLENGES OF THE THREE SERVICES

It would be remiss if mention of the role of industry within context of tactical data link training and interoperability was not included within a pragmatic understanding into the forces that affect tactical data link as a capability. The North Atlantic Treaty Organization and United States have created the standards for tactical data link equipment and operating procedures. Industry interprets these standards and develops and provides the tactical data link equipment in accordance with defence contract specifications. Usually, fulfilment of tactical data link contracts for militaries includes significant training and assistance in

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[106] *Ibid*, pg 2

[107] *Ibid*, pg 2

[108] *Ibid*, pg 2

integrating the capability. Several trends have evolved to meet this requirement. Frequently specialized military tactical data link operators are hired by a company winning the contract as a method of rapidly integrating a new system and fulfilling contractual obligations. The method used historically for this training is to "train the trainer".[109]

Increasingly industry is being called upon as a consultant to assist in the integration of complex systems that are controlled by a command and control system that utilizes tactical data link. Often these command and control systems are purchased from industry as an off the shelf solution referred to literally within the military as "Commercial Off The Shelf" or COTS. Inherent with many COTS systems are software upgrades that ensure compliance with changing tactical data link standards and emerging technology. The acquisition of increasing numbers of COTS systems that utilize tactical data links have created a significant challenge for a training system that has based its method on training simple, static systems.[110] It is clear that the manufacturers of tactical data link equipment are significant stakeholders in interoperable tactical data link training solutions for no other reason except that effective training assists in marketing more systems.

There is currently no entity within the Canadian Forces that has taken permanent responsibility and made progress with any of the areas of concern for this large joint capability, and this is problematic. This lack of support may be, in part, due to the additional complexity of Link-16 not being clearly articulated and explained to senior leadership. The

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[109] Tobias, S. Applying Coalition Standardisation to Enable Interoperability. February 2009, p.7.

[110] *Ibid*, pg 8

Air Force has created a TDL CONOPS in which they clearly state that "the exploitation of information is a key element in the overall decision-making process."[111] Insight might be gained from other nations, as Australia and the UK have TDL authorities that appear to be functional. For Australia, these authorities are defined by the Australian Defence Forces Tactical Data Link Authority (ADFTA) and for the UK by their Joint Datalink Management Organisation (JDMO).[112]

Creation of the CTP for OP PODIUM required the incorporation of force tracking data from both Canada and the US. Canadian feeds included data from 4 Air Defence Regiment's ASCC Bisons, the Navy's Canadian Patrol Frigates (CPFs), HMCS Algonquin (one of Canada's tribal-class destroyers), the Air forces CF-18 Hornet fighter aircraft, CP140 Aurora maritime patrol aircraft, 42 Radar Squadron's deployed MPN-25 radar, and the Canadian Air Defence Sector (CADS) air picture in North Bay. From the US, the CTP included data from Aegis-equipped warships (including a Ticonderoga-class cruiser and two Arleigh Burke-class destroyers), Air National Guard (ANG) F-15 Eagle fighter aircraft, five US Air Force (USAF) Airborne Warning and Control System (AWACS) aircraft, a maritime feed from Commander Third Fleet HQ in San Diego, as well as the air picture from Western Air Defense Sector (WADS) at McChord Air Force Base (AFB) near Tacoma WA, and some data from the US Border Services. The complexity of multi-link operations for OP PODIUM

[111] *Ibid*, pg 8

[112] A.E. Turnbull, *Directorate of Air Staff Operational Research,* Tactical Data Links Study**,** DRDC CORA TM 2010-034, March 2010, Table 4 of p. 20.

is suggested by Figure 4.1[113], which depicts the connectivity realized between OP PODIUM entities.

4.4 - LESSON LEARNED

Most militaries attempt to utilize lessons learned as a basis of refining Tactics, Training and Procedures (TTPs) so that lessons learned are actually learned and not just identified. At best, lessons learned rapidly transform teaching points, new tactics and standard operating procedures into an agile method of optimizing and exploiting technological capability from recent operations. In the worst cases lessons learned remain lessons observed; lessons that are noted but no action taken to resolve the problem and are doomed to repeat.

The lessons learned from the various tours since the initial deployments of the ASCC in support of operations in Afghanistan have led to the continuous development of standard operating procedures for both the ASCC and the other assets in which it coordinates but lacks on offering solutions on the integration of different protocols and feeds needed in-order to offer a RAP to the supported arms commander.[114] For future operations, the lessons learned in reference to Coalition and Domestic operations such as OP PODIUM demonstrated that a more joint and complex cell will be needed for the next expeditionary effort. The embryo of

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[113] Dr. J.A. Steele, *Directorate of Air Staff Operational Research*, Tactical Data Links capability development Study**,** DRDC 3554-1 (H/Air Section), 13 August 2010, p.5.

[114] P. Beauchamp. The Challenges of the Network needed for the Airspace Coordination Center (ASCC) In the Infrastructure of JTFA. Dated Mar 2010

this organization could reside within the newly formed JHQ under the Coordination of Fire and Effect Cell.

While the scope and limits of TDL management have been developed over time, currently there are no specific national or international definitions. This is due in part to the fact that TDLs are continually evolving, and while some countries may have a better grasp of the problems involved, there is still ambiguity and uncertainty for all of the countries involved and specifically for the ones that are trying to develop their own capability. Standards have been developed (including the US joint multi-link TDL operating procedures and NATO ADatP- 33) and they help inform each nation's plan for TDL, but they are not uniformly clear and specific.

Within each nation, there is a certain level of knowledge about all the components of TDLs and how these might be implemented but this technical understanding is lacking on how to implement the system which would include operating procedures such as how responsibility will be allocated within the nations. In addition, it is currently unknown how these areas of responsibility will be divided up within environments (Air, Maritime, Land), jointly, and perhaps multi-nationally. All components of the military – from senior leadership to individual platforms – have the ability to participate in TDL management, but it should be recognized that this is a system that is meant to be used in a joint and international environment and as a result, it should be managed at a level that has the ability to do this well.

When two or more different nations are operating within close proximity of one another, such as during coalition operations, the employment of the equipment is asymmetric. The nations would use, for example, their equipment to support their own missions. During their operations, their priorities, phasing, geographical needs to focus on, would be different. Because the efforts are not synchronized, it is entirely possible that equipment would not be made available to support each other's national operations, occurring at the same time. As well, the limitations of communications equipment, their differences and relative asymmetric employment, the lack of integration capability from some sensor and the protocol differences renders the exchange of information difficult, if not sometimes impossible.

By using TDL, the management of the battlefield space is simplified, flexible and takes into consideration the differences of each nation's different situation during operations. But from the experience obtained in Afghanistan, the lack of a common understanding is more profound than the variation in equipment and connectivity issues. The management function suffers most from the lack of a common doctrine. Coalition efforts toward a synchronized system would be further advanced by the creation of a common doctrine under NATO. It does not mean that the sensors, must be the same, it means that similar effects would be created in the use, employment, data transfer and its management, would be integrated. In order to achieve this, nations would gain in exchanging with their partners their own lessons learned.

Within a military context, "lessons learned" is a process to increase the opportunity that a successful outcome in an operation is repeated and that an unsuccessful outcome is not repeated. "Lessons learned mean the adding of value to an existing body of knowledge, or seeking to correct deficiencies in areas of concepts, policy, doctrine, training, equipment or organizations, by providing feedback and follow-on action."[115] This process ideally would include a method to capture and codify lessons learned and transform the lessons into existing training for new students. Further, those lessons need to be distributed within the groups of practitioners, often called Community of Practice, of a given trade, where those lessons would apply. Operations such as in Afghanistan, but also in domestic operations in Canada have allowed the identification and collection of a significant amount of lessons. Indeed, these joint and combined operations employed tactical data link. These lessons have unfortunately not all been put to use. This is partly caused by an inefficient management of the lessons learned. Some info was codified in unclassified military messages, while others were simply lost. Some of it is simply inaccessible because of limitations and restrictions in enterprise electronic filing, or is simply quarantined in separate systems due to over classifying.

Lessons learned process is normally most effectively applied within a small group such as post operation debriefs for a squad of soldiers. With larger operations and the integration of joint and combined operations the staffing process increases the time to effectively transform lessons into organizational change. There is a belief that within a networked organization that lessons observed are shared and acted upon rapidly, however,

[115] DAOD 8010-1, Operational Lessons Learned Process. http://www.admfincs.forces.gc.ca/dao-doa/8000/8010-1-eng.asp

the challenge associated with instituting effective change throughout a national force with separate commands for the army, navy and air force with independent training systems should not be taken for granted.

As stated, a war cry that summarizes a decade of lessons learned on a number of issues concerning tactical data link interoperability is to train the way we intend to fight. In an unclassified military message summarizing tactical data link lessons learned from the military campaign of the United States led operation known as Operation Iraqi Freedom, Joint Forces Command released the following summary:

> *"Operational planners need more education on roles, capabilities, and limitations of TDLs... We will always fight our wars in a joint or coalition environment. Large joint-coalition training must become the norm vice the exception...Additionally, joint tactics, techniques, and procedures (JTTPS) need to be improved and practiced. Development of JTTPs combined with their inclusion in large scale exercises as well as smaller unit training will significantly improve our joint interoperability and lower the possibility of fratricide in future wars...coalition partners need to be fully integrated into the JICO Cell in order to provide the most concise TDL picture available."*[116]

[116] Joint Forces Command, United States Military Message. (2003). *Results of Operation Iraqi Freedom (OIF) Multi-Tactical data link (TDL) Network (MTN) Lessons Learned Conference 25-29 August 03.*

4.5 CORROLATION BETWEEN LESSONS LEARNED AND INTEROPABILITY

Certainly these lessons learned add support to interoperability in TDL training including the requirement for a coordinated plan to integrate Allies into future training, exercises and direct integration into the coordinating cell that integrates TDL in large scale operations. Large scale exercises involving tactical data link should provide opportunities to train operators from different nations and elements collectively to validate lessons learned and validate adaptive changes in standard operating procedures that incorporate interoperability where possible this effect may be replicated using simulation.[117] The call for an improvement in JTTPs is an acknowledgment of the requirement to build greater capacity in creating an adaptive method of transforming lessons learned into effective capability.

Opportunities for large scale joint and combined exercises should include tactical data link training in settings that promote interoperability. Lessons learned from this process should be used as a validation to confirm the effectiveness of national and Alliance standards in operating procedures training and delivery. Operational lessons learned must have an efficient means of being communicated within the tactical data link Community of Practice. A potential means of distributing lessons learned may be the same portal as a potential Alliance wide training network to support ADL. Such an initiative would require significant resources and transformation in traditional training concepts to include a capability, career wide knowledge management approach.[118]

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[117] Tobias, S. Applying Coalition Standardisation to Enable Interoperability. February 2009, p.29.

[118] *Ibid, 29*

4.6 - SUMMARY

Developing a truly joint integrated TDL capability is achievable in Canada as demonstrated with the capability put in-place for the last two domestic operations. In a domestic context like OP PODIUM and CADENCE, it has the proven ability to provide a Recognized Picture for Canada 24/7 for a period up-to 30 days putting all of the CF assets together and with proper preparation time such as OP SILVER and GOLD. The CF has the equipment to create a national joint integrated picture today however the number of available ground entry sites limits this capability. TDL-related conclusions resulting from OP PODIUM are: a single joint TDL network residing 24/7 within Canada is in the interest of the CF; the equipment necessary to build a nascent TDL capability exists within the CF but need to be centralized; a permanent JICC will be required to support a national joint TDL capability. The Multiple Unit Link Test & Operational Training System (MULTOTS) facility at CFB Esquimalt and Canadian Air Defence Sector (CADS) at North Bay are possible locations for a permanent JICC as both locations possess the structure, the equipment (ADSI and MIDS) and a suite of capable sensors that can be integrated; a joint national TDL architecture will require all TDL operators to work from a single Operational Tasking Data Link (OPTASKLINK); and it will be preferable that a national TDL capability be led by a Joint Commander.[119]

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[119] 3350-1 (RICO), Capt Mirosnikov, Adrian. Operation PODIUM post operation report – Joint Interface Control Cell – Deployed, dated 25 Mar 2010

CHAPTER FIVE

EQUIPMENT AND ESTABLISHMENT

5.1 – INTRODUCTION

The process of implementing a TDL to ensure interoperability via the developments of common protocols is a complex one that requires specialized training mixed with operational experience. Its functionality is relatively new in Canada and that is limited by the lack of qualified personnel across the forces.[120] The JICC requirement is, by its very nature, a joint one and understanding this joint concept is critical. As discussed in chapter 4, issues arose on deployed operations, in Canada and abroad. The major difficulties were identified in para 4.3. One of the key elements in the diagnosis and the provision of solutions may be in having representation from the three elements when problem solving. OP PODIUM in particular has produced a core group of highly trained and specialized experts from whom each element can glean vital operational information from in the future. These experts have helped build and develop standards that will be employed on a National level throughout the three services in the future.[121] Yet the challenges related to the acquisition of an appropriate structure are multifaceted and complex: Issues pertaining to the equipment needed and to the development of a new capability within an already unbalanced structure are greatly affected by the formulation of an adequate acquisition management plan. The

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[120] A.E. Turnbull, *Directorate of Air Staff Operational Research,* Tactical Data Links Study**,** DRDC CORA TM 2010-034, March 2010

[121] 3350-1 (RICO), Capt Mirosnikov, Adrian. Operation PODIUM post operation report – Joint Interface Control Cell – Deployed, dated 25 Mar 2010

latter is influenced greatly by budgetary constraints, both regarding the acquisition and maintenance of the equipment, but also the development of the training and maintenance of adequate skills through simulation and exercises. This chapter will discuss of possible strategies available to implement such reorganisation.

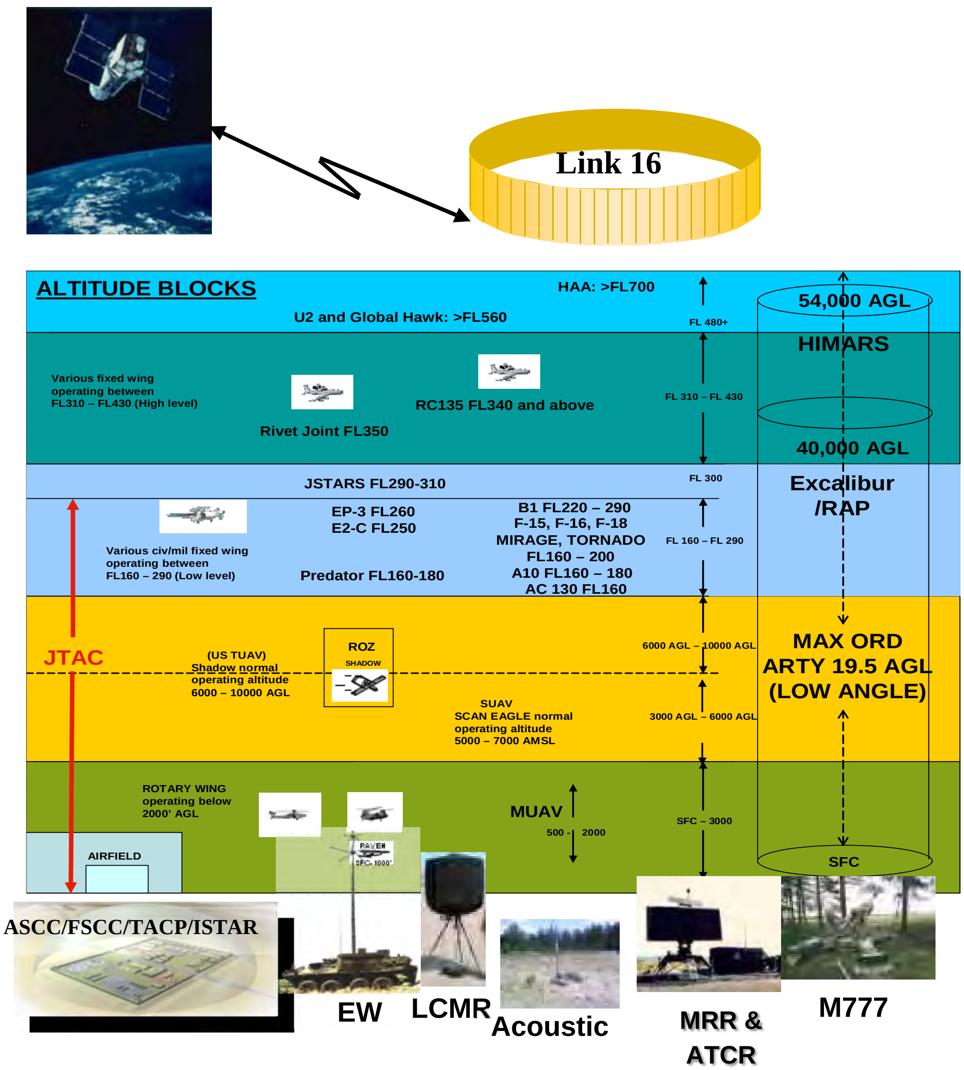

Figure 5.1 – Current Canadian forces JTDL capability.[122]

Figure 5.1 is a graphic representation of how the battlespace is managed in the Area of operations of JTFA by the ASCC. This construct is, for the moment, the only one possible

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[122] AMSL: Above Mean Sea Level (feet). AGL: Above Ground level (feet). FL: Flight Level (in hundred of feet). EW: Electronic Warfare. LCMR: Lightweight Counter Mortar Radar. MRR: Multi-Role Radar. ATCR: Air Traffic Control Radar.

with the current status of equipment deficiencies identified previously in the context of deployed operations. Two important features should be noted in this diagram. The first one is that a lot of different users transit over the Canadian AO and are affecting the coordination of its integral resources. The second is the representation of the procedural control that needs to take place below 5000Above Ground Level (AGL) in feet encompassing the difficulties with integral sensors to properly managed the activities of Mini Unmanned Aerial Vehicle (MUAV), SOF, rotary wing assets and fire support. Positive control and the coordination for the delivery of all fire and effects between 5000 – 30000AGL is coordinated through the Joint Terminal Attack Controller (JTAC) who directs the action of combat aircraft engaged in close air support and other offensive air operations.

5.2 – STRUCTURE

The spectrum of coverage, as discussed at chapter 4, can rarely be done by only one nation without tremendous costs to a military. It is often the addition of coalitions' assets that permits, or enables entire coverage. Canada does have some capabilities which are unfortunately spread between the three elements of the Land, Air and Maritime components. This structure is not the most efficient, since the components acquire equipment according to their needs, as opposed to being based on an approach that would encompass the whole of the spectrum. This seems to be further exacerbated by the human nature of resistance to changes and the "stove-piping" effect as well as the competition between components for budget allocation. Thus, the need for a comprehensive restructuring strategy can take two forms: either one central agent leads the changes, taking into account the needs of each components and how these can be fitted into the strategy; or the structure is developed from the “bottom up”, where each component responds to their needs and a C2 system is developed to integrate all components together. Since the structure must also be capable to be exported into a coalition environment, there still exists a need to develop a nexus at a certain point. Perhaps the development of a common doctrine prior to the acquisition of equipment would serve this purpose.

But regarding comprehensive, integrated structure development, it is necessary to look at a potential answer. As stated before, a series of lessons were identified from past experience, and trials took place with a view to defining and developing a structure. The issues were twofold: there was a need to integrate actors which normally do not operate with the CF; and the difference in capabilities between each component was such that integration was difficult to achieve. So it was thought that the restructuring of JICC-D could help in synchronizing the effects. All of the elements in the military should have the ability to participate, or use the TDL, but management of the TDL should be at the appropriate level for a joint, international environmental asset. A joint concept of operations (CONOPs) should be developed, one that ensures the ability to enforce future TDL direction (funding, personnel, equipment, etc.) and coordination. For the CF, the utilization of this CONOPS could reinforce the idea of the creation a joint cell as described later in this paper (JICC-D) and on-line with the concept of jointness. The concept is the integration of all of the three services airmen, sailors and soldiers into one centralized organisation and with all of the equipment required.

As an example, appendix 1 shows the JICC-D manning requirement that was suggested following OP PODIUM. While some of the equipment showed at figure 4.1 is not part of the CF arsenal, it would be while working in a coalition. These elements add to the complexity of the environment by bringing issues such as language, human elements, differences in equipment and capabilities. This reinforces the need and the importance of integration. Further, the manning requirement is definitely purple in nature, in the sense that all three elements have a part to play in the coverage. The proposed structure can be found at appendix 1. Such a structure would allow, once developed and employed during expeditionary missions under a coalition, to correct such deficiencies as the lack of integration due to differences in language, as demonstrated in chapter 4. This structure would also allow the coordination of effects within the airspace in operations for example like Afghanistan. The point is to put in place a structure that can efficiently integrate all sensors into one COP regardless of the theatre or more importantly of the participants (Air, Army or Navy), and provide a commonality of language and concentration of efforts which would lean toward the integration of each capacity, regardless of their origins: the ADSI and other communication equipment being in all cases the integrator and the way to communicate the data. The Post-operation recommendations proposed after Op PODIUM related to spectrum of coverage and the manning and equipment requirements can be found at Appendixes 1 and 2.

5.3 – EQUIPMENT

The matter of diversity in the equipment, even between platforms aiming at providing the same effects, exacerbates the issue of integration and communication. The transfer of information from one platform to another, the collection and then making sense of it is specific to the role of Data Links. This section presents the technical aspects which influence the choice and effects of the equipment. In an attempt to develop a fully integrated capability, the CF must look at the current equipment and the structure it needs.

The term Data Links refers to several generic data transfer applications including Tactical Data Links (TDL)[123], Tactical Common Data Links (TCDL) and Video Data Links (VDL). Many of these Data Links appear to be similar in name, and may have a common basis. But the issue is that they all have differing protocols and utilities. At this point it is necessary to nuance two of the most important aspects. TDLs encompass the "transmissions of bit-oriented digital information, which are exchanged via data links known as Tactical Digital Information Links (TADIL)."[124] The TDL Program as a whole applies to all encoded message formats used in the context of the entire joint and combined operations for the coordination of all of Tactical Command and Control Systems. Link-16 is synonymous with TADIL J. Similarly; Link-11 is synonymous with TADIL A and Link-4A with TADIL C.[125]

Thus, Tactical Data Links (TDLs) are used in a combat environment to exchange information such as messages, data, radar tracks, target information, platform status, imagery, and command assignments. TDLs provide interoperability, local and global connectivity, and situational awareness to the user when operating under rapidly changing

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[123] Tactical Data Link is military communication links, developed for the transmission of digital tactical information using standardised message formats, protocols and bearer characteristics. TDLs facilitate secure, ECM-resistant communication between military assets.

[124] PE 0604281F: Tactical Data Networks enterprise, February 2010, p.1.

[125] Joint Certification Link 11, Link 11B, Link 16, and *JREAP* - December 2005

operational conditions.[126] TDLs are used by all Service Theater Command and Control (C2) elements, weapons platforms, and sensors. TDLs include, but are not limited to: Link 16, Link 11.[127] There are other components which add to the desired effects regarding the coverage of the spectrum. A summary is provided at Annex B, on their types, purpose and desired effects. What is important to take away is the sheer complexity of the system, which is even more affected by the human nature and differences in operational and tactical application.

"While the option exists to operate in two different nets as for example in either Conventional Link Eleven Waveform (CLEW) or Single tone Link Eleven Waveform (SLEW), to achieve integration between units and ensure connectivity in the same wave form, a link net must be selected. This is called a Link 11 net."[128] TADIL A/B [Link-11] uses a netted link and encoded protocols as a format to exchange the information data's between all airborne platforms using TADIL-A. At the moment, land and maritime platforms use TADIL-B tactical data systems. So a translator that would allow both TADILs to interconnect would be a crucial element to ensure the integration of all systems. Link-11 is

[126] P. Beauchamp. The challenges related to the integration of TDL for the Canadian Forces. Is Purple the new color of LINKS 16? March 2010 (ppt). 9 April 2010.

[127] Link 11 is a half-duplex, netted link that normally operates by roll call from a Data Net Control Station (DNCS). Link 11 can also operate in the broadcast mode. Link 11 can be transmitted on High Frequency (HF) and/or Ultra High Frequency (UHF) bands. Data speed can be selected from bit rates of 2250 or 1364 bits per second (bps). Dual sideband diversity operation and Doppler shift correction features improve reliability and accuracy of data exchange. Link 11 operates on HF (2-30 MHz) and/or UHF (Line Of Sight (LOS) (225-400 MHz). Some Data Terminal Sets (DTS) provide the option to select either the Conventional Link 11 Waveform (CLEW) or the Single tone Link 11 Waveform (SLEW). SLEW and CLEW are not compatible waveforms. SLEW, among other enhancements, provides increased propagation and a more powerful Error Detection and Correction (EDAC) algorithm.

[128] Air Force CONOPS for Data Link 3030-1, dated 05 Dec 2008 (A3 TDL Mgr). Anx B, pg B1- B3

capable to do so; it has also the capability to operate in both communications bands either HF or UHF.

"Advanced Tactical Systems' flagship product is the Air Defence Systems Integrator, more commonly known as the ADSI. In reality, the ADSI is a family of products designed to meet many of today's C4I requirements."[129] The ADSI is the main system owned by the Canadian forces that allows for the integration of all sensors of the three services command and control construct. "This robust system is capable of receiving, forwarding, and displaying tactical information via tactical data links, radar, intelligence links, and other means. It gives operators a versatility they have not previously enjoyed, even with other more costly systems."[130] MIDS[131] is a high capacity, digital information distribution system providing integrated communications, navigation, and identification capabilities. "It is being developed to facilitate secure, flexible, jam resistant information transfer in real time among the dispersed and mobile units characteristic of modern armed forces."[132]

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[129] Ultra Electronics Advanced Tactical Systems: *http://ultra-ats.com/*

[130] ADSI program update, Ultra Electronics. SWA ADSI Update 02-26-06 MJM.ppt

[131] MIDS combines characteristics designed to overcome many of the limitations common to existing systems by providing for increased system capacity and coverage, improved connectivity, survivability, jamming resistance, and reduced danger of data loss and data obsolescence.

[132] William G. Brown, Intro to Links 16 .ppt, ESC/DIVF (Dynamics Research Corp).

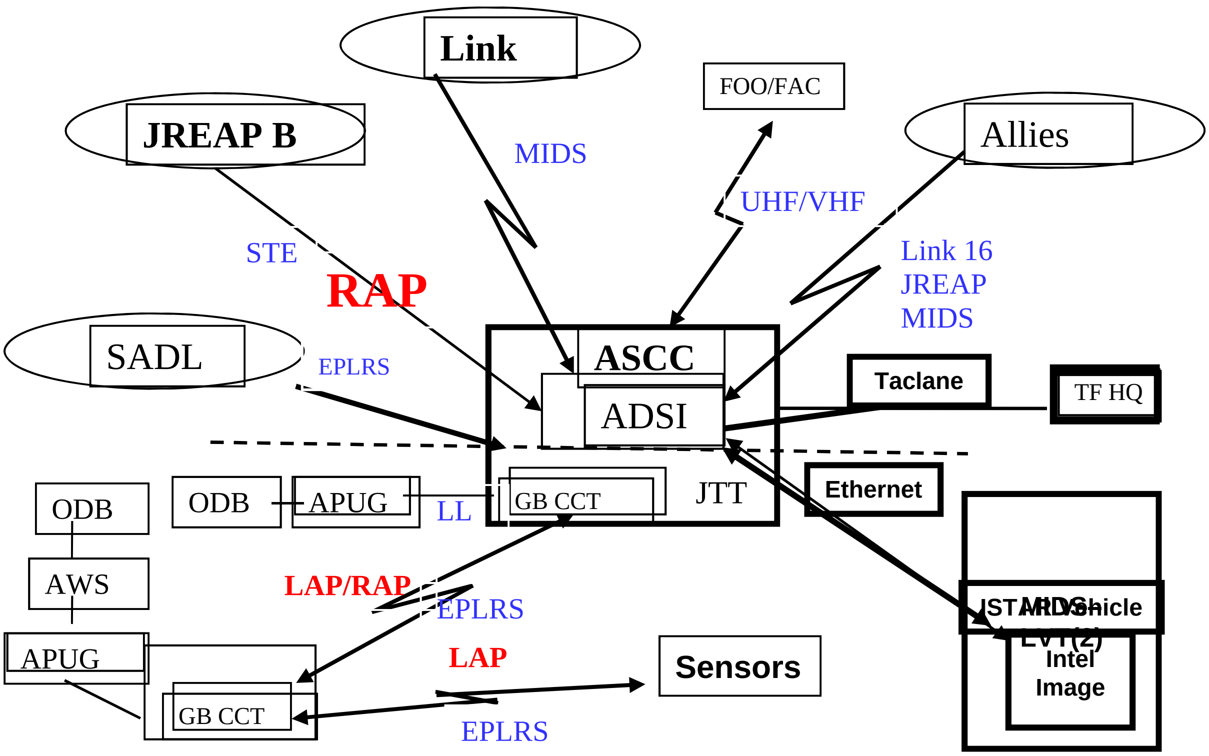

Figure 5.2 – Communications diagram of our current TDL capability.[133]

The figure 5.2 above show the complexity of the system, and the issues related to the management of communications and the information flow within an ASCC. The identification of these issues was the result of a meeting in Fort Bliss, Texas in March 2006 with the experts of the United States Army technical authorities in the domain of TDLs and a Canadian component. The Canadian team was composed of a representative from the Directorate Armoured Vehicle Program Management (DAVPM) 4-2, a representative of the Directorate of Land Requirement (DLR) 2-6 and the Canadian Liaison Officer Air Defence (CFLO AD). The aim was to identify the deficiencies for the equipment and qualifications of

[133] Major Pat Beauchamp-CFLO AD, Visit Report – 2-6 Ex – Fort Bliss, Texas. ASCC support to TF 1-07, March 2006.

the Canadian Forces in order to integrate their system with the Air Defence Air Management (ADAM) Cell and ultimately with a US deployed CAOC. The end result of this analysis was that the configuration of the ADSI needed to be upgraded to the latest certified software release (V12.2), Secure Terminal Equipment (STE) and Joint Tactical Terminal (JTT) needed to be procured. A series of communications equipment related issues were also identified and are summarized at appendix 2.[134]

5.3 - TRAINING

Designing a complex structure would ultimately lead to new ways to train. Further, there is also a need to maintain the skill set necessary to work in the current environment and structure. In such a context, the creation of an environment which would allow the standardization of training becomes essential. This is achieved by ensuring that one body is responsible for planning, designing and maintaining Joint TDL architecture in a Joint Information Control Cell (JICC). In U.S. terminology, the Joint Interface Control Officer (JICO) is this representative body. The training delivered by the US Joint Multi-TDL School based on US Army Forces Command (FORSCOM).[135] The JICO is delegated responsibility for link management and to track data coordination functions, which includes ensuring the clarity, accuracy, currency, and quality of track data displayed on the mission system to meet command and control (C2) and tactical requirements.[136]

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[134] *Ibid,* 3

[135] U.S. Army Forces Command trains, mobilizes, deploys, sustains, transforms and reconstitutes conventional forces, providing relevant and ready land power to Combatant Commanders worldwide in defense of the Nation both at home and abroad.

[136] 3350-1 (RICO), Capt Mirosnikov, Adrian. Operation PODIUM post operation report – Joint Interface Control Cell – Deployed, dated 25 Mar 2010

Yet several issues are to be taken in consideration the first and foremost is indeed the differences between the nations' ability to train specialists. Teaching functions of tactical data link training vary from nation to nation. Some nations that have evolved a specific tactical data link training infrastructure utilise a tiered iterative approach to training with increasing specialisation. At the pinnacle of specialised training, there is a heavy reliance on developing and evaluating tacit skills in a live exercise environment. Even this training is expected to have aspects that could provide a blended training opportunity. The advantage is that it would allow instructors to utilise the online component of instruction and testing with familiar hands-on instruction on specific equipment or provide context, best practices, and lessons learned.

There is support in Canada for evolving an online training environment with initial courses that would be delivered in class and with resultant testing being recorded at a national level. There is also a request to have lessons open to former students to challenge updated lesson tests in order to remain current and preserve perishable knowledge. In short, Canadian tactical data link students desire to take advantage of online delivery, but many feel that a classroom setting with a subject matter expert (SME) present would be the best method of delivery. Another aspect is the seemingly inability to keep specialists in posts sufficiently long to have an appropriate return on the investment of training. This is partly due to career development, and operational needs of the organization. But this results in a constant flux of capacities and prevent the creation of a depth in specialization.

5.4 - MAINTAINING SKILL SET AND KNOWLEDGE

This section will address the relationships between different NATO Standardization Agreements (STANAG) related to the equipment or entity forming the JTDL capability. These entities include the MIDS, the Link as a mean of forwarding data and the Link 16 interface that integrate them together. STANAG 5516 defines a specification for Link 16 to include message standards, operational procedures, data link protocols and network management procedures. As such, it will be the governing document with respect to Link 16 network management, messages, and procedures. STANAG 4175 provides a detailed technical specification for MIDS terminals and specifies how the network management messages and procedures of STANAG 5516 are implemented in the MIDS terminals, and how these terminals will interoperate technically. As such, STANAG 4175 is the governing document for MIDS terminal design.[137]

STANAG 5516 defines a specification for Link 16 to include message standards, operational procedures, data link protocols and network management procedures. STANAG 5511 provides the equivalent information for Link 11/Link 11B. As such, they will be the governing documents for their respective data link(s). STANAG 5616 will provide the specifications for the rules, protocols and translations required for tactical data systems to forward data between Link 16 and Link 11/Link 11B. All systems that intend to provide the data forwarding capability must adhere to STANAG 5616. As such, STANAG 5616 will be the governing document for interpretation of these inter-link translations.[138]

[137] STANAG 5516: Tactical Data Exchange – Link16 dated 02/06

[138] *Ibid*, 7

The Link 16 interface is intended to provide improved information distribution, relative navigation, and identification capability in support of inter- and intra-Allied tactical command and control and mission execution functions. These functions will also be supported by information exchange via other digital data links, e.g., Link 11 and Link 11B. For effective accomplishment of these functions, there must be an unrestricted flow of information between the Tactical Data Systems (TDSs) serviced by a network of digital data links. "This requires that selected Command and Control (C2) TDSs interfacing with multiple links provide for transferring data between the dissimilar links without altering the intent of the information exchanged."[139]

5.5 – BUDGETARY ISSUES

> *"Our analysis shows that the CF has spent $4 billion since the early-1990s on projects related to C4ISR and plan to invest a further $6 billion over the next 10 years. The Navy, Army, and Air Force cannot afford to individually pursue C4ISR systems development, nor should they."*[140]

This section will address the budgetary constraints and their effects on the way ahead for TDL and its restructuration. Costs associated with individual nations developing training objects are significant in terms of the resources required. Staffing changes and approval of

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[139] Link16 Training package. NCS, dated Jan 2010. Pdf

[140] Fraser, S. (2005). *National defence — C4ISR initiative in support of command and control.* Retrieved September 21, 2006, from the Office of the Auditor General of Canada: http://www.oag-bvg.gc.ca/internet/English/osh_20050421_e_23427.html

new tactical data link training standards impose significant latency on the ability to deliver useful training objects. “Costs in training should not be separated from the total investment in new capability. Without having properly trained specialists, the desired capability is not achieved, and the organisation fails to meet its own expectations.”[141]

Capturing the cost of investment as it relates to solving a capability deficiency is key in a value-based assessment. “In 2004, there are three projects to develop tactical data link capability within the Navy and the Air Force, estimated at $175 million, of which $25 million has already been spent by the Department.”[142] Recent additions in procurement bring the current figure over $200 million. Training and recruiting programs must be developed in time to have skilled people available when needed.[143] “We are concerned that work to resolve human resource issues are not advancing at the same pace as the rest of the C4ISR transformation, putting at risk the ability of the Department to meet its own demands.”[144] The investment must be made in human resource issues to allow for the successful completion of these types of projects.

Costs associated with training by some organisations have been a perceived method of reclaiming the investment in developing training by remarketing it among alliance

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[141] Tobias, S. Applying Coalition Standardisation to Enable Interoperability. February 2009, p.17.

[142] Fraser, S. (2005). *National defence — C4ISR initiative in support of command and control.* Retrieved September 21, 2006, from the Office of the Auditor General of Canada: http://www.oag-bvg.gc.ca/internet/English/osh_20050421_e_23427.html

[143] Tobias, S. Applying Coalition Standardisation to Enable Interoperability. February 2009, p.17.

[144] Fraser, S. (2005). *National defence — C4ISR initiative in support of command and control.* Retrieved September 21, 2006, from the Office of the Auditor General of Canada: http://www.oag-bvg.gc.ca/internet/English/osh_20050421_e_23427.html

members. The Advance Distributed Learning System (ADLS)[145] represents a unique opportunity to supplement Military Assistance and multinational initiatives, including the Partnership for Peace (PfP), North Atlantic Treaty Organization (NATO), the Technical Cooperation Program, and others, to export appropriate military learning while recouping a reasonable fee for use. The revenues generated by this portion of the ADLS should be returned to support learning technology programs, which will provide further savings in development, conversion, and updating of the backlog of courseware required, but unfunded, for use by the deployed war fighter.[146]

Cost of training should be viewed pragmatically and be weighed against the cost of inaction which may lead to the expectations of tactical data link capability not functioning effectively or effectively enough to meet expectations. The cost associated with training development can not only be viewed monetarily but also in the commitment in cost of ownership and the allocation of adequate resources. "Nations and their respective army, navy and air force must conduct a capability related task analysis to define common levels of training and specialization with associated tasks and responsibilities that nations and services can align national training standards with."[147]

5.6 - SIMULATION

[145] The vision of the ADL Initiative is to provide access to the highest-quality learning and performance aiding that can be tailored to individual needs and delivered cost-effectively, at the right time and in the right place.

[146] Tobias, S. Applying Coalition Standardisation to Enable Interoperability. February 2009, p.17.

[147] *Ibid*, p.29

While Link 16 technology offers a robust, secure, high-capacity backbone for integrated C4ISR of network enabled joint operations; its effective and efficient exploitation requires considerable investment beyond the necessary hardware. The extent to which it supports each component of CF mandated and common missions needs to be examined so that its component functionalities can be seen in their true light. Investments can then be made in the functionalities of highest priority and in other technologies that better fill the gaps left. Simulation-based exploration of the doctrinal impact of TDLs needs to be undertaken, as simulation-based training in command of joint forces. Both are naturally complemented by the set of capabilities assembled under the JFS TDP now housed at the CFEC. Identification of the trades that will manage TDL networks, adjustment of the their establishments, and the redesign of training and career management must be made before the ad hoc capability advances surrounding high-profile events can have any enduring impact on C4ISR beyond hardware acquisition.

5.7 SUMMARY

This chapter described the challenges related to the acquisition of an appropriate structure. These challenges are multifaceted and complex and pertain the equipment needed, the development of a new capability within an unbalanced structure, and the urgent need for the formulation of an adequate acquisition management plan. The latter is influenced greatly by budgetary constraints, both regarding the acquisition and maintenance of the equipment, but also the development of the training and maintenance of adequate skills through the use of simulation and other coalition exercises.

This paper discussed possible strategies available to implement such reorganisation. The proposed structure can be found at appendix 1. Such a structure would allow, once developed and employed during expeditionary missions under a coalition, to correct such deficiencies as the lack of integration due to differences in language, as demonstrated in chapter 4. It would also allow the coordination of effects within the airspace in operations for example like Afghanistan. The point is to put in place a structure that can efficiently integrate all sensors into one COP regardless of the theatre or more importantly of the participants (Air, Army or Navy), and provide a commonality of language and concentration of efforts which would lean toward the integration of each capacity, regardless of their origins. This can be done easily, but it is important to take into consideration the aspects presented in chapters two, three and four related to the barriers which may affect the development of such a capability in a comprehensive manner.

CHAPTER SIX

CONCLUSION

6.1 – INTRODUCTION

At present time, and until TDL is considered a Joint asset, Joint Task Forces (JTFs) ability to establish a Joint Interoperability Control Cell (JICC) for each deployment will be constrained by the services capabilities to generate the appropriate level of integrated support. This difficulty arises mainly due to the lack of centralized ownership of very limited assets and the highly technical expertises being spread too thin within the present construct.

6.2 - SUMMARY OF FINDINGS

Chapter 1 reflected on the unique standalone capability of JTDLs as a Command and Control systems enabling tactical networked-operations (Network Enabled Operations) amongst numerous critical capabilities that operate within the Joint battle space. Each environment employs individual operating procedures incorporating the TDL. Yet, TDL crosses all environments. This thesis argued that the new joint environment essential to the conduct of our entire operations has dramatically changed the way joint coordination must be conducted. It also proposes concrete steps to achieve substantial improvements in this critical area of joint and combined operations. Finally, and most importantly this thesis demonstrated that there remain significant areas for future research and analysis as technological advances continue to redefine the complexity of Joint Tactical Data Link management in peace and war.

Chapter 2 focused on the developments of Tactical data links especially since the early 1980s with the employment by the Canadian Navy of Link 11 communications between shore locations, destroyers, frigates, and supporting aircraft (currently Sea King helicopters and Aurora long range patrol aircraft). However, the Canadian navy was moved to outfit deploying destroyers with Link 16 not only by the enhanced capabilities it offered, but more immediately by the sudden shift in operational focus after 9-11, Canada's desire to participate with the United States (US) in naval operations in the second Persian Gulf war, and the extent of US military reliance on Link 16 as the backbone of joint C2, so that a meaningful role in those operations was impossible without it. This resulted in the isolation of the Navy, as being the only services having the capability.

Chapter 3 focused mainly on the human dimensions related to the barriers of the centralized implementation of the JTDL capability resides with the pressures caused by systems development. These pressures related to IS projects and their analysis was the object of this chapter in order to draw some of the recommendations below. It was done using the case studies of Chae & Poole (2005), Lin & Silva (2005), Luna & Reyes et al (2005), and Iannacci (2010). The detailed analysis of these case studies were used in order to formulate key recommendations on how to best use the identified constraints of systems development for the best integration of JTDL for the Canadian forces. These recommendations are summarized at para 6.3.

Chapter 4 developed the idea that barriers exit in developing a truly joint integrated TDL capability in the Canadian forces. In a domestic context like OP PODIUM and

CADENCE, it has proven the ability to provide a Recognized Picture for Canada. The CF has the equipment to create a national joint integrated picture today; however the number of available ground entry sites limits this capability. OP PODIUM Lessons Learned have showed that a single joint TDL network residing 24/7 within Canada is feasible and that it is in the interest of the CF; that the equipment necessary to build a nascent TDL capability exists within the CF; but that a permanent JICC will be required to support a national joint TDL capability. The MULTOTS facility at CFB Esquimalt and CADS at North Bay are possible locations for a permanent JICC; a joint national TDL architecture will require all TDL operators to work from a single OPTASKLINK; and it will be preferable that a national TDL capability be led by a Joint Commander.

Another very important aspect of the barriers to the implementation of the JTDL capability resides with the human and structural dimensions playing an important role in systems development. Indeed the progress of practical social-technical methods and approaches is moving very slowly in order to form a common usage within major organizations. Three points are emphasis by Doherty and King related to the literature on information systems: new system failure is very high, the failure to adequately predict and manage the impacts of the implementation of IT investments, and the slow progress in producing socio-technical approaches to address the human and organizational aspects of systems development projects.

Chapter 5 discussed and proposed different network solutions, including recommendations from the lessons learned from all of the domestic and operational theatres and proposed a centralized structure in order to correct some of the deficiencies identified in this paper. Link 16 technology offers a robust, secure, high-capacity backbone for integrated C4ISR of network enabled joint operations; however, its effective and efficient exploitation requires considerable investment beyond the necessary hardware. The extent to which it supports each component of the CF mandated and common missions' needs were also examined. Simulation-based exploration of the doctrinal impact of TDLs needs to be undertaken, as simulation-based training in command of joint forces. Both are naturally complemented by the set of capabilities assembled under the JFS TDP now housed at the CFEC. Identification of the trades that will manage TDL networks, adjustment of the their establishments, and the redesign of training and career management must be made before the ad hoc capability advances surrounding high-profile events can have any enduring impact on C4ISR beyond hardware acquisition.

6.3 – FURTHER STUDY

Recommendations for further studies should encompass the conclusions of each case studied. Because the systems development literature showed that there is a tendency to focus primarily on the system under development and to minimize, segregate or to underemphasize the role of pre-existing information systems. It is important to qualify the effects, positive or negative, of this tendency. As research also recognized the importance of pre-existing systems in the development of a new system, it recognized the material constraints and learning from the experiences of the old system. In the context of the development of the JTDL system, these points support the conclusion that technology development is not the major issue at hand; but the role of pre-existing IS related to this function needs to be taken very seriously. This should be further explored in a quantifiable study, to identify the costs related to such an oversight. An empirical study could lead to potentially define a systemic approach which could result in simulations being run to see cause to effect relations and potential efficiency measures to be implemented.

With regard to IS development, Lin and Silva propose that the context under which a system is evaluated influences the perceptions of the capacity of this system, and that the implementation of an information system will be facilitated by achieving congruent technological frames. They also concluded that the exercise of power between competing services plays a major role in the framing of any information systems. This last proposition suggests that the balance of power may disadvantage the subaltern or sub-groups for the considerations of the management group, thus hindering the development of an acceptable solution. Exploration of further case studies could show how those social pressures influence the acquisition and development system, and suggest ways to conceptualize these pressures in order to prevent their influence.

Luna and Reyes identified four accumulations that help to understand the process of Information System Development (ISD): These four accumulations focuses on the organization itself, the need to know the specific purpose of the system, the requirements and the functionality of the system to be developed. Against the context of the development of the JTDL system, the four accumulations identified in this case study could help in forming the premises for the definition of a strategy of the development of this capability. The recognition of the importance of the system requirements and their functionality in a joint environment is particularly promising.

Iannacci's conclusions are pertinent and they are relevant to the development of new information system such as JTTL. One of these conclusions is "that besides the technical level of software, information infrastructures should first and foremost be conceived at the social level of institutions."[148] He added that the design of electronic systems and the information infrastructures should always be done within the context of the aim of the organization. However, he has explained little on how the aim of the organization influences the decision. Further studies and research should focus on these conclusions to explore and conceptualize the validity of each point into a quantifiable result.

6.4 – CONCLUSION

The purpose of this essay was to identify some of the challenges and key lessons learned from OP PODIUM and Theatre related to the integration of TDL for the Canadian Forces, focusing on the difficulties of integrating all of the hardware and different operating systems that communicate in their own device-specific language. More specifically, the challenges of the human dimensions as it relates to the nature of the different trades, command styles; and challenges posed by the operating environments in which the three services find themselves conducting operations. To magnify the complexity with respect to integration of the TDL in the CF are the issues of the small size of the CF and the budgetary

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[148] Federico Iannacci. When is an information infrastructure? Investigating the emergence of public sector information infrastructures. *European Journal of Information Systems* (2010) 19, p. 46.

limits on the force. The lessons learned from theatre and DOMOPS should convince the three elements of the necessity to find and implement a Joint and deployable solution.

The process of TDL interoperability is a complex one that requires specialized training mixed with operational experience. Its functionality is relatively new in Canada and it is limited by the lack of qualified personnel across the force. While each service possesses a certain level of expertise, the sum of their talents, capability and experience represents exponential benefits to the TDL. The JICC, by its very nature, operates across the battlefield. It is the ultimate expression of a joint environment. Understanding this concept is critical. Having representation from the three elements was essential in diagnosing elemental failures and providing solutions to issues as they arose. This operation produced a core group of highly trained and specialized experts which each element can glean vital operational information from in the future. These experts have helped build and develop standards that will be employed on a National level throughout the three services in the future. From this point of view, TDL including Link16 integration is definitely a joint endeavour that needs to be managed, sourced and nurtured by the CF leadership to ensure operational and strategic relevance while delivering tactical effects to a joint commander.

Appendix 1 - JICC-D MANNING REQUIREMENT [149]

24/7 OPS x 30 DAYS

1 x Capt Shift Commander	Should be qualified JT 101, 102, 201 and 301 or equivalent
1 x MWO / WO Shift Commander	Should be qualified JT 101, 102, 201
1 x Sgt Shift Commander	Should be qualified JT 101, 102, ADSI, MIDS
2 x MCpl Shift Commander	Should be qualified min trade requirement + JT 101, 102, ADSI, MIDS
4 x Cpl / Pte Operator	Should be qualified min trade requirement + JT 101, ADSI, MIDS
1 x MCpl / Pte Operator	Technical trade ATIS, LCIS, NET(C)

ELEMENT	TRADE	QUALIFICATION
Air Force (ICC)	AC Operator – Shift Commander	Data Link Manager
operator / Interface control tech	AC Operator – Operator	DLO / ICT Data link
or equivalent	AEC – Officer	JT 101, 102, 201, 301
Army	Artillery Air Defence – Shift Commander Artillery Air Defence – Operator	AD Tech supervisor AD Tech Course
JT 101, 102, 201, 301 or equivalent	Artillery – Officer	Troop Commander,
Navy	NCIOP – Shift Commander NCIOP – Operator	QL5B and above QL5A
Coordinator	MARS – Officer	Surface Weapons
Weapons Coordinator		Anti Surface
		JT 101, 102, 201, 301

JT-101 provides instruction in joint operational procedures and capabilities of Link 16 equipped systems. JT-101 covers all aspects of Link 16, from technical theory to operational employment. Students learn Link 16 Joint/Allied terminology, features/functions, employment, and network design documentation. The course is

[149] 3350-1 (RICO), Capt Mirosnikov, Adrian. Operation PODIUM post operation report – Joint Interface Control Cell – Deployed, dated 25 Mar 2010.

geared towards the operators of Link 16 equipped systems. There are no JMTS course prerequisites for JT-101. JT-101 is currently 23 instructional hours/ 4 training days in length.

JT-102 MAJIC provides instruction on Joint C2 organizational structures and joint/coalition planning considerations, along with Joint Tactical Air Operations (JTAO) interface management fundamentals. Specific data link instruction includes Link 16 (JTIDS), Link 11/11B, Situational Awareness Data Link (SADL), and other joint data links. Students receive training in Operational Tasking Data Link (OPTASK LINK) message interpretation and preparation. Currently, there are no JMTS course pre-requisites for MAJIC. MAJIC is 71.5 instructional hours/10 training days in length.

JT-201 provides instruction in advanced Link 16 concepts, Joint Tactical Information Distribution System (JTIDS)/Multifunctional Information Distribution System (MIDS) capabilities and how they relate to planning. Students are required to plan and brief a Link 16 network. The course is geared towards personnel with at least 2 years experience in operating Link 16 planning for training events, exercises and contingency operations. The JMTS course pre-requisites for the Link 16 Planner course are: JT-101 and JT-102. The Link 16 Planner course is 88 instructional hours/10 training days in length.

JT-301 provides joint training to service personnel who will be tasked with the responsibility for planning, designing, and managing the Joint Multi-TDL Networks (MTN) as a JICO, Joint Track Data Coordinator, and/or TDL Manager. The JICO course provides academic instruction; Joint Interface Control Cell (JICC) equipment hands-on experience; and operational training. JMTS course prerequisites for the JICO course are the JT-101, JT-102 and JT-201 courses. The JICO course is approximately 180 hours/22 training days in length.

Appendix 2 – ASCC shortfalls[150]

4th Air Defence Regiment, RCA
PO Box 6100 Stn LCD1
Moncton NB E1C 9L4

3010-2 (2IC)

February 2010

Commander
Land Force Atlantic Area
PO Box 99000 Station Forces
Halifax NS B3K 5X5

ASCCs EQUIPMENT SHORTFALLS

References: A. 3010-2 (BC 119 AD Bty) dated 20 Nov 09
B. Email from DLR 2 date 14 Jan 10 in response to Ref A

1. The aim of this letter is to follow-up on the recommendations provided by ref B and more specifically to officialise the process of acquisition and support of this equipment via the new project ACCS. 4 AD Regt currently does not have the ability to deploy any operational ASCC Bison or ADSI in-the-box with MIDS Link 16 capability without out-sourcing. This limiting factor has not lessened the demand for support of combined exercises like Ex Halcyon, Ex Maple Guardian and NATO CASEX Goose bay.

2. 4 AD Regt requires action on the following items in order to gain the capability to train deploy and support ASCC operations including Link 16 venue for the five Bison's ASCC and the three ADSI in-the-box that comprise its capability. Deficiencies are identified in the table below:

System	Components	Own	Need	Deficiencies	Notes
BISON ASCC	ADSI	5	5	0	Sub-para c.
	Amplifier/vehicle tray	1	5	4	Sub-para d.
	MIDS	0	5	5	Sub-para a.
	MIDS Cooling Tray/ Power Supply	0	5	5	Sub para d.
	MIDS Antennas	0	5	5	Sub para a.
	XM25 Cable	0	5	5	Sub-para d.
	W3 Cable	0	5	5	Sub-para d.
	Rad M+	0	5	5	Sub-para b.
	Vixam Mast	0	10	10	5 X MIDS; 5 X VHF/UHF Sub-para d.
System	Components	Own	Need	Deficiencies	Notes
Stand-Alone ASCC	ADSI	3	3	1	1 X ADSI N/S 3rd Line Sub-para c.
	MIDS	3	3	1	1 X MIDS Beyond Repair
	MIDS Cooling	3	3	1	1 x N/S Power Supply

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	Tray/Power Supply				Sub-para d.
	MIDS antennas	3	3	0	Sub-para d.
	XM25 Cable	1	3	2	Sub-para d.
	W3 Cable	1	3	2	Sub-para d.
	117f (Man pack)	0	3	3	Sub para b.
	Vixam Mast	0	3	3	3 X MIDS. Sub-para d.

a. MIDS radios. As stated in Ref B, the Regt acknowledges the need of the diagnostic software that will be sent this month. The two available MIDS radios are deployed in support of Op HESTIA and Op PODIUM, no further ability to support Link 16 is available within 4 AD Regt. Without second and third line support in place, our capability would be further reduced in the event of equipment failure. The deficiency is six;

b. AN/PRC 117f. Of the five ASCC Bisons fitted for/not with AN/PRC 117f within the Regt, only one is equipped with a vehicle tray mount and amplifier for AN/PRC 117f. Operators are limited to man pack UHF when communicating with Air Assets, and Tac Sat capabilities can not be exploited. The deficiency is five and three Man packs;

c. ADSI. Deficiency is one. The regiment is also requesting that ACCS project looks at the flexibility and advantages that we can gain in purchasing mini ADSIs. This capability can allow more room in the BISON provide a remote capability (full ADSI) outside of platform (JHQ or penthouse); and

d. Cables / Amp / Trays / Antennas / Masts. In order to guarantee full capabilities of the Regt, the following items are necessary: seven XM 25 cables, seven W-3 cables, four 117f amplifiers/vehicle trays, five MIDS antennas, and 13 Vixam Masts. Individual and collective training necessary to provide JICC personnel in support of Op PODIUM, and ASCC crews will not be possible until equipment shortages are rectified.

3. Due to the complex technical nature of the communications suite in the ASCC, it is critical that I have a sufficient critical mass of serviceable equipment to allow for necessary individual and collective training, support to joint exercises, and deployments to domestic and international operations. This is vital if I am to prevent skill fade of the highly perishable skill sets amongst my ASCC Bty. It is also recommended that the project looks at converting the voice cards from LVT2 to 11 for three of the five Bisons in order to enhance our compatibility with Joint and Combined Assets.

4. In conclusion, I would like to mention the outstanding cooperation of DAVPM and DLR in view of resolving these serious deficiencies. If you have any further questions in regards to this matter, please do not hesitate to contact myself, or have your staff liaise with my BC of 119 AD Bty, Major Rod Embree, CSN 860-5021.

J.A.Y. Audet
Lieutenant Colonel
Commanding Officer

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