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AIR TRAFFIC SERVICES – A CORNERSTONE OF MULTINATIONAL OPERATIONS AND POST-CONFLICT RECONSTRUCTION

By /par Major Bernard Rousseau

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Contents

List of Abbreviations

3D+C	Development, Diplomacy, Defence and Commerce
8ACCS	8 Air Communication and Control Squadron
ADB	Asian Development Bank
ADS	Automatic Dependent Surveillance
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATCU	Air Traffic Control Unit
ATM	Air Traffic Management
ATS	Air Traffic Services
AAF	Ausland Assistance Force
CF	Canadian Forces
CIDA	Canadian International Development Agency
CNS	Communication, Navigation, Surveillance
DART	Disaster Assistance Response Team
D-ATIS	Datalink Automatic Terminal Information Service
DFAIT	Department of Foreign Affairs and International Trade
DME	Distance Measuring Equipment
FAA	Federal Aviation Administration
FANS	Future Air Navigation System
FSS	Flight Service Station
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
HF	High Frequency
HN	Host Nation
IBRD	International Bank for Reconstruction and Development
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rule
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IMF	International Monetary Fund
JAOC	Joint Air Operation Center
NATO	North Atlantic Treaty Organization
NCTI	NavCanada Training Institute
NDB	Non-directional Beacon
NGO	Non Governmental Organization
NOTAM	Notice to Airmen
PAR	Precision Approach Radar
SATCOM	Satellite Communication
SARPs	Standards and Recommended Practices
TACAN	Tactical Air Navigation
UHF	Ultra High Frequency
UN	United Nations
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization

VFR	Visual Flight Rule
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omni directional Range

Abstract

This paper develops the potential contribution Canada could deliver in the field of aviation in the context of multi-national operations and post-conflict reconstruction through a whole-of-government approach. Aviation shortens distances and brings people closer. In countries like Afghanistan where distances, rough terrain and tribalism conspire to split societies, aviation is a critical element of integration, governance, security, economic growth and inclusion within the global economy. As a basic enabler to aviation, a modern air traffic system (ATS) is essential to the effective and safe employment of air power and to the development of a healthy national air transport system. A modern ATS is a complex, highly technological and far reaching structure that needs a well trained and equipped core of air traffic services specialists, modern and reliable infrastructure, and a solid regulatory framework. These requirements may place an unbearable burden on countries that have been weakened by years of conflict or economic distress. Canada is a rich nation with great ideals of humanitarian involvement and remarkable aerospace capabilities. In concert with international organizations such as ICAO, Canada has the opportunity to deliver a significant contribution to a country's ATS. Through a whole-of-government approach, Canada could first support the rapid deployment of both troops and humanitarian aid with its deployable military ATS capability. After, it could focus its efforts and those of Canadian industry to offer a complete ATS solution in support of multinational operations and post-conflict reconstruction.

Introduction

In its short history, aviation has sped up the development of nations and greatly influenced many aspects of modern life. Initially a hobby for adventurers, aviation was quickly recognized for the great speed and flexibility it afforded those who used it. During WWI, powered flight evolved well beyond its amateurish beginnings, proving itself in military operations. Soon, aviation began civil service in mail delivery, survey, and transportation.

Around the world, aviation is touted as a key enabler for economic development, governance, stability, security and humanitarian assistance. In a press release issued in March 2003, Terje Wolden, a World Bank senior transport specialist, said that "[s]olving the problem of Afghanistan's transport problems is absolutely essential to both short-term recovery and long-term development …".[1] This article made the announcement of a US\$ 108 million credit to the Afghani Government for the urgent rehabilitation of roads and civil aviation program. In a paper presented by the U.S. to the International Civil Aviation Organization (ICAO) at the first meeting of the Civil Aviation of the Caribbean Region, the authors noted that "[a] safe and efficient aviation system is critical to the growth of economies and the integration of Latin American and Caribbean countries in the world economy."[2] Also, that paper highlights that investing in a country's aviation

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[1] The World Bank, "Afghanistan: World Bank to Help Revitalize Highway and Aviation Networks," http:/web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:20097859%7Emenu PK:34463%7EpagePK:34370%7EpiPK:34424%EthesitePK:4607,00.html; Internet; accessed 8 January 2007.

[2] United States, "International Civil Aviation Organization, First Meeting of the Directors of Civil Aviation of the Caribbean Region (CAR/DCA/1) - Enhancing Aviation Safety in Latin America and the Caribbean: Funding Possibilities,"; (8-11 October 2002); available from http://www.icao.int/icao/en/ro/-nacc/meetings/2002dcacar1/cardca1-ip21.pdf; Internet; accessed 8 January 2007.

system promotes tourism, commerce, nation-building and political reform as well as enhances lifesaving and humanitarian operations.

Aviation is no stranger to Canadians. In Baddeck, Nova Scotia, the Silver Dart was the first airplane flown in the British Empire. Large numbers of Canadian aircrews flew with the Allied Forces during the two Great Wars, and this country contributed significantly to the training of Commonwealth pilots during WWII. In the 1990s, Canada was the sixth largest aerospace nation in the world. Bush pilots opened up the Canadian North[3] and today, aviation remains a key enabler for the development of our resources from sea to sea to sea.

Canada is a developed country that is rich in resources, a well educated population, and vibrant aviation and infrastructure industries. These resources and know-how could be exported to the benefit of both our country and those less fortunate in accordance with our national core values. The current Minister of Foreign Affairs and International Trade articulated our core values along the lines of: freedom, democracy, respect of human rights and the rule of law.[4] As well, this country has national interests such as its defence, its economic well-being, a stable world and the promotion of Canadian values.[5]

In the name of their values and in support of national interest, Canadians of all horizons, both civilian and military, have served overseas to help in the pacification,

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[3] Transport Canada, *Speaking Notes for Transport Minister David Collenette at the Annual Meeting of the Civil Aviation Medical Association, Toronto, September 16, 1999*. Available from http://www.tc.gc.ca/mediaroom/speeches/1999/990916_cama.htm; Internet; accessed 8 January 2006.

[4] Peter Mackay, "Canadian Presence Improving Afghan Lives," *Toronto Star*, 4 September 2006, A15.

[5] Macnamara, Bgen (Ret)Don, "Introduction to National Security Studies," (lecture, Canadian Forces College, Toronto, ON, September 1, 2006) with permission.

stabilization, re-construction, and development of failed and failing states. Familiar

around Foreign Affairs, the Armed Forces and many more Canadian organizations

interested in international development, is the concept of Diplomacy, Defence,

Development and Commerce, the three Ds plus C which constituted the four pillars of

Canada's international policy statement under the previous government. The concept of

3D+C or what is called the "whole-of-government approach"[6] under the current

Conservative Government involves the packaging of Canadian capabilities such as the

Military, Foreign Affairs, International Development, other government departments and

industry into a coherent offer to another country in order to enhance its development.

As we saw above, aviation is a cornerstone for post-conflict reconstruction and

development. A pioneer in aviation, Canada has been the home to the International Civil

Aviation Organization (ICAO) since its foundation in 1947.[7] Both our civil and military

aviation sectors are the envy of many. As well, this country has a solid reputation for its

regulatory framework and flight safety record, and it has a vibrant aeronautical industry.

Firms like NavCanada, Raytheon, XWave, AECON Group, SNC Lavalin and many more

have a world-wide reputation in the conception, construction and operation of aerospace

projects.

I, the author of this paper, have been a military air traffic controller for over 20

years. My interest in this area comes from the opportunity I had to deploy to Kabul,

Afghanistan, for six months in 2004. There, I was an air liaison officer and a forward air

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[6] Foreign Affairs and International trade Canada, "Afghanistan and Canada's International Policy - Canada's Role in Afghanistan," http://geo.international.gc.ca/cip-pic/current_discussions/kandahar-en.asp; Internet; accessed 23 January 2007.

[7] ICAO, "Web, Library and Archives – Library Overview – 50 Years of the International Civil Aviation Organization's Library," http://www.icao.int/icao/en/adb/wla/libinfo.htm#ch1; Internet; accessed 20 January 2007.

controller. Then, I had the chance to see first hand the criticality of aviation and the nascent efforts made by the international community to rebuild a nation's air traffic system. During the same period, as it did in other theatres in the past, the CF deployed other controllers to provide temporary help to the international stabilization assistance force (ISAF) by manning the Kabul control tower at the request of its coalition partners.

With its riches and strength in the aviation industry, Canada has a great potential to offer complete aviation packages to needy nations. This paper will develop the potential contribution the Canadian Forces (CF), Transport Canada, Foreign Affairs, Canadian International Development Agency (CIDA), NavCanada and Canadian industry in concert with international organizations such as ICAO could deliver in the context of multi-national operations and post-conflict reconstruction.

The study of aviation in its entirety at the appropriate level of detail would be impossible in the time and space allocated to this study. Aviation as an industry includes all air assets; those that fly and those that are ground-based, as well as both hard assets, and intangible assets such as knowledge and regulation. For the purpose of this paper, only those assets, knowledge, regulations and persons that support Air Traffic Services (ATS) will be considered in terms of Canadian technical assistance. They are usually ground based and usually serve a specific national entity even if the service they provide is often used by others. Therefore, in the remainder of this paper, the focus will be on airports, Air Traffic Control (ATC), meteorology, flight safety, personnel, training and regulatory issues.

This paper is divided into three parts. First, the needs for a solid ATS will be demonstrated and a baseline for an ATS based on the ICAO standard and inspired by

both FAA's and Canadian's model will be established. Second, the international

environment, and the many resources and options the Canadian Government has at its

disposal to support the development of an ATS will be studied. Finally, a high-level

Canadian aid package focusing on the development of a country's ATS to be employed

within the context of an international operation of peacekeeping and post-conflict

reconstruction will be demonstrated.

Part 1- A Tool for International Operations and Post-Conflict Reconstruction

Aviation has contributed to the development and unification of countries and

empires. Canadian history is marked with the prowess of its bush pilots who defied

geography and climate to open its Great North. Today still, most communities in

Nunavut, the North West Territories and Yukon are accessible year-round by airplane

only. Aviation remains the only reliable and rapid link they have to the government,

advanced health care, critical supplies, and markets to support their economic

development.

Europeans, in the early 1900's, used aviation "to establish rapid and close ties

with their colonies and to visually demonstrate their sovereignty in their territories."[8] A

good example of this, were the efforts the U.K. made to develop its air links with its

Asian colonies. Today, air assets are extensively used by the UN, national forces and

other organizations for multinational operations and post-conflict reconstruction to access

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[8] K. Raguraman, "Airline as Instrument for Nation Building and National Identity: Case Study of Malaysia and Singapore." *Journal of Transport Geography* Vol. 5, No. 4 (1997): 240.

rapidly even the remotest areas of the globe, thus extending the helping hand of advanced economies.

The U.S. has significantly contributed to the modeling of world wide ATS as we know them. Since the signature of the Chicago Convention in December 1944, which formed ICAO[9], the Federal Aviation Administration (FAA) and its predecessors have constantly been agents of progress in terms of procedures, regulations and systems. For example: the English language is the standard for communications, many American technologies are part and parcel of ATS and the U.S. Government is deeply involved in the development and standardization of procedures and regulations.

The backbone of the aviation capability is the availability of safe and efficient ATS. As stated above, ATS comprise: airports, ATC, meteorology, flight safety, personnel, training and regulatory framework. Therefore, after having understood the importance and applications of a modern ATS, this part will conclude with a detailed description of a functional ATS with a view into the Future Air Navigation System (FANS).

Multinational Operations and Post-Conflict Reconstruction

In the early 20th century, the first flyers felt that aviation defied geography as its reach was unhindered "… by oceans, deserts or mountains, and that it greatly collapsed distance in terms of time."[10] Today still, aviators see their community in a similar light as shown by this abbreviated list of characteristics pertaining to modern aerospace power

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[9] ICAO, "Strategy – Guiding International Civil Aviation into the 21st Century." Available from http://www.icao.int/icao/en/pub/strategy.pdf; Internet; accessed 15 December 2006, 5.

[10] K. Raguraman, "Airline as Instrument …, 240.

as listed in the Canadian Aerospace Doctrine Manual: elevation, reach and speed.[11]

Elevation provides the ability to observe and influence activities on the surface and below

the sea.[12] Unimpeded by surface features, aviation enables global reach.[13] The great

speed inherent in aviation enables rapid response over long distances; that speed may also

help in attaining surprise and reducing risk to friendly troops by limiting the duration of

their exposure to threat.[14]

Multinational Operations

Multinational operations and post-conflict reconstruction such as what is

underway in Afghanistan presents a significant challenge to "advanced societies" for

many reasons. Yet, "Canada, and the world, have a strategic interest in a secure, self-

sufficient, democratic and stable Afghanistan that never again provides a safe haven for

terrorists or terrorist organizations."[15] Afghanistan and the many other countries that

currently or could potentially benefit of our support are often remote, have very poor

transportation infrastructures and are often dangerous to travel by vehicle. Therefore,

when supporting operations or post-conflict reconstruction in such countries, aviation is

often the better means to transport personnel and critical supplies to and within a theatre

of operations.

Aviation is needed to bridge obstacles and to provide freedom of the air to bring

troops and equipment to their destination, sustain their operations and help in their

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[11] Department of National Defence, *Canadian Forces Aerospace Doctrine*, (Ottawa: Director General Air Force Development, 2006), 27.

[12] *Ibid.*, 27.

[13] *Ibid.*, 28.

[14] *Ibid.*, 28.

[15] Foreign Affairs and International trade Canada**, "**Afghanistan and Canada's...

protection against aggression. During post-conflict reconstruction, aviation offers access to otherwise inaccessible areas and enables rapid liaison between parts of a country and the rest of the world. Throughout, aviation bolsters government presence, law, order, economic development, security and a sense of national unity.[16]

Many other Canadian operations of the past fifteen years such as those in Haiti, the Former Yugoslavia, Somalia and East Timor clearly highlighted our dependency on access to safe and efficient aviation transport that must be supported by ATS. The Canadian Forces (CF) Disaster Assistance Response Team (DART) as well relies primarily on airlift to deploy its capabilities anywhere in the world at a moments notice. Aviation provides the DART with the flexibility, reach and speed it needs to respond to worldwide events.

Intra-theatre movements in countries that do not have well working rail or road systems, where mountains or other terrain features are significant or where distances between camps are too long, might need to be done using aviation assets. In the case of NATO's current operations in Afghanistan, air transport of troops and supplies to outposts is often the safest way to operate, as the threat of improvised explosive devices and other assaults is significant. Most importantly, the only way to provide immediate medical attention to deployed troops is often through air evacuation.

A solid ATS is needed for these aviation assets to effectively support operations, one that can be deployed in areas of operations, before reconstruction begins, even as conflict rages. Without airports, ATC, meteorology and underpinning enablers such as

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[16] Dr Waleed Youssef, "Afghanistan Civil Aviation Sector, Definitional Mission Study," Report prepared by The Berkeley Group for the U.S. Trade and Development Agency (1 November 2002); available from http://www.export.gov/afghanistan/pdf/afghanistan-AviationDM.pdf; Internet; accessed 8 January 2007, 1.

flight safety, personnel, training and regulatory framework, safe and efficient operations would not be possible in the densities required to support a large deployed force. For these reasons and to support the reconstruction of the Afghan country, the International Security Assistance Force (ISAF) has provided ATS in Afghanistan since February 2002.[17]

Post-Conflict Reconstruction

Dr Waleed Youssef, Managing director at The Berkeley Group[18] authored a report for the U.S. Trade and Development Agency that provided a compelling case for the promotion of a solid ATS as part of post-conflict reconstruction. He wrote that "[r]estoring a vibrant and efficient civil aviation sector is a prerequisite for the reconstruction of Afghanistan…"[19] Indeed, aviation together with the underlying ATS, connects people together thus fostering national integration, eases the movement of goods which supports a more vibrant economy, and enables the rapid dispatch of humanitarian aid in remote areas. Although written in the context of the re-construction of Afghanistan after years of conflict and destruction, the arguments forming the basis of this report are applicable across the spectrum of post-conflict reconstruction and economic development in most countries.

Before the study of other national examples however, a more complete our tour of the Afghan situation will be done as it provides a perfect example of the critical

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[17] United States, "Kabul Airport Navigation Aid Rehabilitation," U.S Trade & Development Agency, Project Resource Guide – Afghanistan: Rebuilding a Nation (June 2003); available from http://www.export.gov/afghanistan/pdf/transport_1-kabul_airport.pdf; Internet; accessed 8 January 2007, 2.

[18] The Berkeley Group is an independent consulting firm that provides an integrated range of infrastructure development and transport advisory services to large and small businesses, organizations, and institutions. Source: http://www.b-group.com/aboutus.html.

[19] Dr Waleed Youssef, "Afghanistan Civil Aviation Sector…, 1.

contribution of ATS to post-conflict reconstruction. Afghanistan is a mountainous land-locked country that is sparsely populated.[20] Its road network is in poor shape due to years of combat and neglect. For example, the main road between Kabul and Kandahar, a 506 km trip, will slow travelers down to an average speed of 25 km/hr and extend travel time to about 20 hours.[21] For comparison, the flight time between Kabul and Kandahar on a civilian type turboprop aircraft would take one to two hours depending on aircraft type.

Even if roads were good, the crossing of mountain passes with the inherent detours and the changing weather conditions at altitudes that reach above 10 000 feet transform any travel into this country in a true adventure as this author has experienced first hand. It is for these reasons, that "[t]here is extensive civilian traffic between Afghan airports employing aircraft operated by the United Nations (UNHAS), International Red Cross and Red Crescent (IRCRC) and various non-governmental organizations (NGOs)."[22] These international organizations must be allowed to operate efficiently to bring relief to a population that faces shortages of the most basic necessities of life.

Afghanistan, like other developing countries faces civil unrest due to weakened governments, poor economic and social prospects, crime and tribalism. It must make special efforts at unifying its population under a common flag. The security and stability of Afghanistan relies greatly on the ability of its government to positively influence the life and perception of its citizens, even those who are the most isolated. Again, given the

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[20] *Ibid.*, 5.

[21] Asian Development Bank, "Comprehensive Needs Assessment for Rehabilitation and Reconstruction in the Transport Sector, Afghanistan," *Asian Development Bank* (August 2002); available from http://www.adb.org/documents/others/cna_afg/transport/cna_afg_transport.pdf; Internet; accessed 8 January 2007, 7.

[22] Dr Waleed Youssef, "Afghanistan Civil Aviation Sector…, 6.

remoteness of many areas of Afghanistan, the use of aircraft may be the only way to

rapidly, reliably and decisively project the government's actions and will. [23]

Finally, ATS can be a powerful economic development tool. As the Afghan

Minister of Public Works indicated during a speech in 2004, "… the civil aviation sector

will be crucial to support high value export industries in Afghanistan."[24] It will support

increased tourism once the security situation permits, and help in the export of goods that

can be efficiently air transported. A very good example of air transport's contribution to

commerce in places where centers are dispersed and significant obstacles to ground

transport exist is the vibrant commercial activity between Kabul and Beirut that existed in

the commerce of karakul skins (a pricey sheep skin).[25] A robust ATS that meets

international standards set-out by ICAO is a cornerstone to the development of countries

like Afghanistan.

In other countries and for many years now, the economic, social and humanitarian

benefits of aviation have been recognized. In an article in *The American Economic

Review* published in May 1962, Hans Weyman Jr. from the Rand Corporation indicated

that in sparsely populated countries, where terrain and climate are exceptionally hostile

and traffic density is too low to justify significant investment in ground transportation, air

transport is efficient at speeding up development. As well, it contributes to breaking

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[23] Afghanistan, "Afghanistan: Rebuilding our Nation – Afghanistan's National Programme for Reconstruction," available from http://www.export.gov/afghanistan/pdf/national_program_for_recons-truction.pdf; Internet; accessed 8 January 2007, 14.

[24] Afghanistan, "Afghanistan Development Forum - Transport National Program, Speech presented by His Excellency Abdullah Ali, Minister of Public Works, 20-22 April 2004," available from http://www.export.gov/afghanistan/pdf/transportation_sector_april_2004.pdf; Internet; accessed 8 January 2007, 4.

[25] Hans Heymann Jr. "The Role of Transportation in Economic Development – Air Transport and Economic Development: Some Comments on Foreign Aid Programs," *The American Economic* Review Vol 52, No 2 (May 1962): available for http://links.jstor.org/sici?=0002-8282%28196205%2952%3A2%-3C386%3AATAEDS%3E2.0.CO%3B2-P; Internet; accessed 19 December 2006, 393.

social isolation, and it is "remarkably effective at uncovering, protecting and benefiting a nation's natural resources."[26]

In his article titled "Airlines as instruments for nation-building and national identity: case of Malaysia and Singapore", K. Raguraman from the Department of Geography and Centre for Transportation Research at the National University of Singapore noted that in the 1930s, "[a]viation was seen as key facilitator in raising Malaya's standard of living and bringing the country closer to other nations in time and outlook…"[27] At the dawn of WWII, the U.K. realized the importance of aviation with regard to strengthening imperial communications. Aviation was seen as a tool to promote national objectives, enhance effective government and support organizations like the postal services, which provided citizens with a tangible advantage. Finally, in the late-1940s, during a period of unrest in Malaya, airlift was preferred over road or rail as either were not always available and presented increased risks.[28]

Moving West, the U.S. promoted many regional initiatives to encourage economic growth through aviation infrastructure development. In remarks prepared for delivery by the U.S. Secretary of Transportation at the Open Skies for Africa Aviation Conference in June 2001, it was noted that "[s]afe, secure and dependable air transportation is vital to the economic development and well-being of the countries of Africa."[29] Highlighting the importance of ATS as studied in this paper, the three goals of

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[26] *Ibid*., 386-387.

[27] K. Raguraman, "Airline as Instrument…, 241.

[28] *Ibid*., 244.

[29] U.S. Department of Transportation, "Remarks as Prepared for Delivery U.S. Secretary of Transportation Norman Y. Mineta, U.S Secretary o f Transportation Open Skies for Africa Aviation Conference Washington, D.C., June 28, 2001," http://www.dot.gov/affairs/062801sp.htm; Internet; accessed 14 December 2006.

the Safe Skies Initiative are to increase ICAO safety standard compliance, improve airport security, and to enhance air navigation services in the African region.

Similarly, an information paper presented by the U.S. at the ICAO 7th Meeting of the Civil Aviation Authorities of the SAM (South America) Region, states that: "A safe and efficient aviation system is critical to the growth of economies and the integration of Latin America and Caribbean countries in the world economy."[30] It also acknowledges that there is a need to invest in these countries' aviation infrastructure to enhance tourism, commerce, post-conflict reconstruction, political reform, life-saving transport and humanitarian operations.

By now, it is clear that ATS, as the basic enabler for aviation, are a cornerstone of multinational operations and post-conflict reconstruction. ATS are needed to enable the safe arrival of a force in theatre, its sustainment, its continued operation, including its intra-theatre mobility up to its re-deployment. An aspect that can easily be forgotten however, is the importance of aviation infrastructure and services to provide safe and efficient access to other government organizations, NGOs and benefactors. As well, for the reconstruction of a country to begin, contractors and business person of all kinds need the ability to move safely and rapidly to and within the country. Finally, for the future economic and social development of a country, people and cargo must travel efficiently to or from the country and within the country itself.

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[30] United States, "International Civil Aviation Organization, Seventh Meeting of the Civil Aviation Authorities of the SMA Region (Salvador, Bahia, Brazil) - Enhancing Aviation Safety in Latin America and the Caribbean: Funding Possibilities,"; (1-3 July 2002); available from http://www.icao.int/-icao/en/ro/nacc/meetings/2002dcacar1/cardca1-ip21.pdf; Internet; accessed 8 January 2007.

Often, when a multinational operation is undertaken, ATS within a country have been destroyed in their entirety, as was the case in Afghanistan, or have been rendered ineffective to varying degrees. As well, the level of threat against foreigners can become unacceptable to contractors. In these situations, it is important to establish ATS, even if rudimentary, using military assets and personnel.

However, the military is not mandated, equipped and manned for long term ATS operation in a foreign country. The host nation must at a certain time be able to assume the control over its airspace and operate its own ATS. However, as is the case in Afghanistan, there is often nothing left to rebuild on: no equipment, no qualified personnel, miserable infrastructure, no training facility and no framework. It is in these circumstances that the "whole-of-government approach" is most useful. As armed forces establish a foothold and ensure the day to day operation of critical airfields, they must already plan their exit. The CF should develop with local authorities, Canadian and coalition partners, as well as with the appropriate international agencies such as ICAO the reconstruction or "remise en forme" of the ATS. The rest of this paper is focused on just that.

Air Traffic Service System – High Level Model

An ATS, as defined in this paper, is a complex structure that spans infrastructure, personnel, equipment, training, procedures and legal framework. To better understand its complexities, it is preferable to progressively introduce the many concepts that underpin its functionalities. For this purpose, this section will first summarize the development of the United States' ATS, which the was precursor in the world aviation. Second, the components of a national ATS will be studied through its seven functions. This section

will close with a brief exploration of the future air navigation system (FANS), the communications, navigation, surveillance/air traffic management (CNS/ATM) and the global air traffic management operational concept that will shape aviation.

Evolution of the U.S. ATS

In the early days of aviation, following the successful experiment of the Wright Brothers on 17 December 1903, many saw flying as a pastime. As early as 1911 however, air transport entered commercial service through mail delivery.[31] Aviation progressed significantly during WWI. New and better aircraft entered production, pilots were trained and the industry as a whole gained credibility. The after-war period was an exciting time for civil aviation. The US mail system began routine airmail service in 1918. As well, aviation's commercial use was expanded into agriculture and the first transatlantic flight was completed in 1919. This progress in aviation engendered a pressing need for ATS.

In those early days, flying was restricted to day-time and good weather conditions only, which greatly limited efficacy. The first navigation aids (NAVAIDS) began addressing limitations to night flying as early as 1921. Then, ground based light beacons were laid along the desired aircraft's path from the point of departure to its destination, guiding pilots along what would become known as airways. In 1926, the Air Commerce Act came in effect with the stated aim to promote the aviation industry and to regulate it "as necessary to elevate the public's perception of aviation as a safe mode of

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[31] Michael S. Nolan, *Fundamentals of Air Traffic Control* (Belmont, CA: Thomson Learning Inc, 2004), 2.

transportation."[32] Hence, licensing for pilots and mechanics, as well as regulation on the use of airways began. The Act also brought forward aircraft airworthiness certification and formal accident investigation.[33]

The first air-to-ground radios installed on board aircraft in 1927 paved the way to modern air navigation. Still, flights were conducted mostly during day-time and under Visual Meteorological Conditions (VMC) to enable pilots to see incoming traffic and avoid collisions. As technology improved, aircraft flew faster and higher, and under weather conditions that would not enable visual flights. These conditions were called instrument meteorological conditions (IMC). When operating an aircraft in IMC, aircrew use two-way radios to communicate with air traffic control (ATC) and special radio receivers to navigate along airways. In 1936, the Bureau of Air Commerce established rules called instrument flight rules (IFR) to be followed when flying in IMC.[34]

Then, the major airlines developed early airway traffic control units (ATCUs), which had control over certain blocs of airspace.[35] Aircrews wishing to fly under ATC had to file a flight plan, and establish contact with a controller. As a flight progressed from point to point, aircrews would pass position reports to ATC which used them to confirm aircraft position and maintain traffic separation. This separation would be either

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[32] *Ibid.*, 4.

[33] U.S. Centennial of Flight Commission, "The Government Role in Civil Aviation – An Overview," http:/www.centennialofflight.gov/essay/Government_Role/POL-OV.htm; Internet; accessed 8 January 2007.

[34] Michael S. Nolan, *Fundamentals of Air Traffic Control…*, 10.

[35] Such a bloc of airspace could be visualised as a three dimensional air corridor extending longitudinally between to cities like Toronto and Winnipeg, laterally for a certain width allowing safe aircraft operations, and vertically to enable the simultaneous passage of aircraft over a single geographical location.

longitudinal, lateral; or vertical within the assigned airspace to ensure that even in poor weather conditions, aircraft would not collide.

Although civil aviation almost came to a halt during WWII, enabling technologies and process made tremendous strides. Radars made their appearance, radio systems for both navigation and communication greatly evolved; approach control facilities and the precursor to the flight service stations (FSS) were developed.[36] These advances catapulted aviation into the modern era.

ICAO was created in 1944 by the Convention on International Civil Aviation.[37] Soon, it selected the U.S. navigation and communication systems, and the English language as the worldwide standard for ATC.[38] In 1948, a special committee articulated the basic requirements and the tools that laid the foundation of today's ATC system. The requirements identified were to ensure the safety of flight, the orderly and expeditious traffic flow, that airborne equipment be simple and lightweight, that new equipment imposed minimum burden on both air and ground crews, and that equipment used must make economical sense.[39] Common systems developed to meet these requirements included: VHF omni directional range (VOR), distance measuring equipment (DME), airport surveillance radar (ASR), instrument landing system (ILS) and precision approach radar (PAR).[40] The description of these systems and the context of their usage will be provided in the next section of this paper.

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[36] Michael S. Nolan, *Fundamentals of Air Traffic Control…*, 18.

[37] ICAO, "Strategy – Guiding International Civil Aviation …, 1.

[38] Michael S. Nolan, *Fundamentals of Air Traffic Control…*, 18.

[39] *Ibid.*, 20.

[40] *Ibid.*, 20.

The Federal Aviation Administration (FAA) was created in 1958 to address many of the systemic shortcomings that plagued previous national organizations.[41] The rest of the 1960s, 70s, 80s and 90s were spent further developing air navigation systems, airports and procedures that enabled the accommodation of the spectacular growth the aviation industry has enjoyed throughout the years.

Current Air Traffic System

The ATS currently in existence around the world results from the evolution discussed above. Many of the procedures and most of the hardware are carry-overs from the pre-satellite, pre-digital age. Controllers still guide pilots via analog radios, coordination between controllers is still often done by voice over a phone line, and ground-based NAVAIDs still often mark airways and guide aircraft on approach. In this section, the paper will present ten phases of flight to provide the reader with context on the main functions of ATS. Then, it will further describe the seven functions of an ATS that fall within the scope of this work. Finally, it will provide a high level identification of the components, human and material, that support each function.

Phases of flight. According to ICAO's "Global Air Traffic Management Operational Concept" publication, a flight comprises ten segments for the purpose of ATS: planning, ramp, surface departure, departure, dispersion, cruise, collection, approach, surface arrival and ramp.[42] During the planning phase, the pilot acquires the information needed to the conduct of flight such as weather conditions, airport of departure and arrival as well as enroute infrastructure conditions. Based on this

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[41] *Ibid.*, 26.

[42] ICAO, *Global Air Traffic Management Operational Concept First Edition* (Montréal: ICAO, 2005), I-12.

information and other non-ATS considerations, a flight plan is filed, processed and an ATC clearance is prepared. During the ramp phase, aircraft are moved to and from their parking locations to be prepared and loaded. This movement can be accomplished under the aircraft's own power or in-tow.

The next phases are those most common to passengers. During the surface departure phase, the aircraft obtains its IFR clearance[43] if it has not been received yet and taxies on the airport's surface to reach the departure queue. During this phase, the pilot will communicate with a ground controller whose responsibility is to provide a safe and efficient routing, and to issue any last minute information on the condition of the airfield. Once in the departure queue, responsibility for the control of the aircraft is passed from the ground controller to the aerodrome controller who, like the ground controller, issues any last minute information, and clears the flight for take-off. This is the departure phase.

Once a flight is airborne, its control passes from the aerodrome to the departure controller. In this dispersion phase, the aircraft flies up and out of the vicinity of the airport into the airway structure. As the flight progresses in the climb, in the cruise, the collection and the approach phases, the crew contacts a number of air traffic controllers fulfilling specific duties in well defined areas. An aircraft's flight might be guided by a controller using radar to issue direction and altitude or may be cleared enroute via a number of points-in-space using NAVAIDs. Often, the departure, dispersion, collection and approach phases are controlled by radar. The cruise phase is more often along airways, marked by NAVAIDs that crews follow using onboard receivers. As a flight

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[43] An IFR clearance is the authorization given by an air traffic controller to a pilot to fly to a destination via a specified route, at a set altitude.

approaches its destination, it is sequenced in an arrival queue which aims at providing an

orderly traffic flow into the airport. Following this phase called collection; an aircraft is

consecutively cleared for an approach and for landing on a runway.   Once the aircraft

has moved off the runway, in the surface arrival phase, the crew contacts the ground

controller and obtains direction and information pertaining to its movement back to the

gate.

This simple ten step process highlights directly or indirectly many of the functions

and enablers necessary to safe, orderly and expeditious flights. Now that a basic

understanding of a flight's process has been established, the remainder of this section will

focus specifically on the seven operational functions of ATS that fit within the scope of

this paper: airport, ATC, meteorology, flight safety, personnel, training and regulation.

The seven functions of ATS are an amalgam of CNS/ATM's operational functions as

envisioned by ICAO[44] and FAA[45].

Airport. For the purpose of this paper, airports will include runways, taxiways,

ramps and terminal buildings, as well as the operations, maintenance, fire and rescue, and

security functions. Transport Canada's TP 312, "Aerodromes Standard and

Recommended Practices Manual", provides guidelines on runway design. For example,

runway length should be based on the type of aircraft for which the airport is intended

and on local factors such as temperature and altitude.[46] Runways of 8 000 to 10 000 feet

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[44] ICAO, *Global Air Traffic Management Operational Concept* …, iix-ix.

[45] FAA, "The Federal Aviation Administration – National Airspace System Architecture," http:\//www.nas-architecture.faa.gov/nas/view_service/hometree.cfm?svhid=103; Intenet; accessed 26 January 2007.

[46] Transport Canada, *TP 312 Aerodrome Standard and Recommended Practices Mannual*, available from http://www.tc.gc.ca/CivilAviation/publications/tp312/Chapter3/3-1.htm#3.1.1; Internet; accessed 18 March 2007.

long and 150 to 200 feet wide are quite common in both military and commercial operations. This said, Hercules (C-130) and Globemaster (C-17) aircraft are designed to operate from much shorter runways that may or may not be paved. Taxiways, like runways, should be developed considering the aircraft types that will operate on an airport. They should enable the easy access to and from the runway and limit the risk of runway incursion by their design.[47] Taxiways of 75 to 100 feet wide are quite common. Ramps, also known as aprons, are those areas used for the parking, loading and servicing of aircraft. The size of the ramp should be sufficient to enable the handling of aircraft during periods of peak traffic. Aprons should be solid enough to handle the weigh of aircraft, cargo and handling equipment, and be sloped to reduced water accumulation.[48]

Airports need terminal buildings of size and sophistication commensurate to the traffic they support. The Kandahar military terminal was a sober plywood building that served as the focal point for check-in. At the other end of the scale, the Toronto Pearson airport terminals are both architectural feats and complex infrastructures serving thousands of passengers every day. For the purpose of this paper, an airport terminal would be just large enough to support basic operations, perhaps resembling the rustic Kandahar military terminal.

In addition to infrastructure, many functions support the smooth operation of an airport. In the following lines, only those essential functions of operations, maintenance, fire and rescue and security will be discussed. The operations functions involve the human and material resources necessary to the airport's smooth operation. It includes,

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[47] Transport Canada, *TP 312*…, available from http://www.tc.gc.ca/CivilAviation/publications-/tp312/Chapter3/3-4.htm; Internet; accessed 18 March 2007.

[48] Transport Canada, *TP 312*…, available from http://www.tc.gc.ca/CivilAviation/publications-/tp312/Chapter3/3-6.htm#3.6.1; Internet; accessed 18 March 2007.

but is not limited to, directing and planning staff, flight line workers as well as communications equipment enabling the coordination of airport employees and contractors.

The maintenance function enables the continuous operation of the airport through the installation, update and repair of airfield equipment, buildings and surfaces. Hence, depending on the beginning state of the infrastructure, local climate and flight operations type amongst others, the resources required to the fulfillment of this function may vary immensely. The most basic requirements are the ability to repair and maintain the airport's surfaces, which means runway repair, snow clearing and sweeping. As well, a number of tradesman and engineers are needed to keep airfield lighting; power, water and sewage; and buildings in working condition.

A fire and rescue capability in its simplest expression may be constituted of fire trucks, fire fighters and alerting equipment to respond to most airfield emergency situations. On military bases, the fire hall is often responsible for the containment and cleanup of moderate hazardous material spills as well. The fire and rescue response capability available at one site is a function of aircraft types operating at that airfield and the level of risk accepted by its operators. For instance, a forward operating base in Afghanistan might not have much in terms of fire and rescue to protect its helicopters. However, the Kandahar airfield, like the Kabul airfield, has a complete fire and rescue response capability.

The basic security function includes airfield security, which consists of controlling access to the airside, and passenger security and screening. In both cases, the security apparatus may vary greatly depending on the place and situation. While

passengers usually go through a thorough security screening in developed country's airports, it might be a question of walking across a field to a waiting aircraft in a remote area. The level of effort invested in security is function of many variables that a study of mission specific requirements and circumstances dictates.

Air Traffic Control. In this sub-section, ATC is defined very broadly to include both its main and supporting functions. More specifically, it includes: advisory, separation/control, traffic flow and synchronization, airspace management, flight planning, aeronautical information, and communication, navigation and surveillance. Advisory services are normally provided to aircraft where low traffic levels would not justify the provision of control services, or when the situation would preclude the provision of such services. Advisory is the work of military flight advisors and flight service specialists. Usually, advisory services include but are not limited to the processing of flight plans, the provision of traffic and meteorological information, the relay of ATC clearances, and the alerting for the purpose of missing aircraft.

Separation or control services consist of tactical guidance to aircraft either in flight or on the ground to ensure the safe, orderly and expeditious flow of air traffic. Control spans both the IFR and VFR domains, is taught in specialties (VFR and IFR). It is the function of air traffic controllers working from control tower and control centers. Traffic flow and synchronization is the duty of controllers who monitor and adjust air traffic with a view over a longer temporal horizon. Working at a higher conceptual level, they ensure that local conditions and traffic densities reflect the ATS' capacity. Airspace management situates itself in an even longer temporal horizon; it looks at airspace structure and long term usage to maximize throughput.

From an ATS perspective, flight planning involves the receiving and processing of a flight plan. Amongst others, this function enters a flight plan in the air traffic control system to expedite the work of air traffic controllers. The aeronautical information function provides the products and information, either in print or electronically, to all users concerning all aspects of aviation. This function produces aeronautical charts, approach plates, airport information documents, notice to airmen (NOTAM) and much more.

Communication, navigation and surveillance are the technical backbone of the ATS. Today, air-to-ground communications are primarily done through high frequency (HF), very high frequency (VHF) or ultra high frequency (UHF) radios, the same way it was done from the 1950s. HF is used for long range communications but is getting replaced progressively by satellite communications (SATCOM). On the other hand, VHF and UHF[49] are used for line of sight communication.[50] Although digital communications have made great strides, verbal analog transmissions remain the most commonly used.

While the communications segment enables the coordination and control of flight, navigation is what provides guidance along a flight path. This guidance is still provided in good part by systems developed half a century ago. These systems consist of non-directional beacons (NDBs), VORs, tactical air navigation (TACANs), distance measuring equipment (DME), ILS and precision approach radar (PAR).[51] All of these navigation aids, except for the PAR, broadcast a signal that is received and processed by

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[49] UHF radios are used by the military.

[50] Michael S. Nolan, *Fundamentals of Air Traffic Control…*, 171.

[51] Vincent P. Galotti, *The Future Air Navigation System (FANS): Communication, Navigation, Surveillance/Air Traffic Management* (Aldershot: Ashgate Publication Limited, 2003), 120.

an aircraft's onboard equipment to provide course guidance. A NDB is a basic radio beacon that aircraft may use when flying point-to-point in a similar way as pilots were flying from light to light in the early days of night flying. It is also used as a marker on a number of instrument approaches.[52] Both VOR and TACAN are similar in that their broadcast enables a suitably equipped aircraft to determine its exact position with relation to the navigational aid. It also enables an aircraft to fly along a determine "radial" to/from the equipment which enhances navigation.[53] The DME provides suitably equipped aircraft with its distance from the transmitter. It is often collocated with a VOR and is integral to TACAN which further enhances their accuracy and usefulness. The ILS provides final guidance to an aircraft on approach to a runway. Its very precise signal enables landings in the most severe weather. For example, an ILS category 1 would enable landing with a visibility as low as one half mile and a ceiling of 200 feet.[54] Similarly, the PAR which is used primarily by the military, offers precision guidance to the threshold of the runway. The difference is that a ground operator, the PAR controller, provides verbal control instructions to the crew using three-dimensional radar information. Both the PAR and ILS will enable aircraft to land at night and under adverse weather conditions.

Today, both the American global positioning system (GPS) and the Russian global navigation satellite system (GLONASS) demonstrate reliability and precision, paving the way to a navigation system that relies significantly less on ground-based equipment. These satellite based systems enable receiver-equipped aircraft to fly

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[52] Michael S. Nolan, *Fundamentals of Air Traffic Control…*, 55.
[53] *Ibid.*, 57-73.
[54] *Ibid.*, 97-100.

precisely anywhere in the world without the use of ground based navigation systems. They have entered commercial and military use, and, with time and continued refinement, they should entirely replace the systems described above.[55] Notwithstanding, ground based navigational aids will remain in use in the medium term; it is why they were described above and will receive further attention in part III of this paper.

The surveillance segment consists of ground based radars for the most part which begins to be supplemented by automatic dependent surveillance (ADS). Ground based radars provide controllers with a precise air picture enabling the efficient use of airspace through more dynamic control. Radars however are limited by their range and are costly to operate. ADS, on the other hand, is satellite based, hence it provides global coverage on aircraft suitably equipped. As opposed to radar that broadcasts a signal that must reach the aircraft and return, the ADS relies on the aircraft avionics suite to autonomously broadcasts its position via either satellite or air-to-ground radio to a station.[56] Radar remains needed for both deployed operations and reconstruction of a nation's ATS for the medium term at least.

Meteorology. For the purpose of this paper, meteorological services include the observation, the forecasting and the briefing of weather phenomenon in support of aviation. Timely and accurate meteorological services are critical to safe, orderly and expeditious air traffic. They enable flights to avoid dangerous weather, and help in the planning of paths that capitalize on favorable conditions and mitigate the effects of unfavorable winds for instance. A complete modern ATS needs a distributed network of

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[55] Vincent P. Galotti, *The Future Air Navigation System (FANS) …*, 119-129.

[56] *Ibid.*, 160-1.

observation stations, forecasting services and the ability to distribute meteorological products.

Flight safety. Often taken for granted by a public accustomed to aviation as the safest mode of transportation, flight safety is critical to the preservation of precious resources and is critical to the public's continued support of aviation. A flight safety program is therefore a capital function to any nation serious about building an ATS. For the purpose of this paper, flight safety includes the investigation of incidents and accidents, the analysis of data, the formulation of recommended improvement to process and equipment, and their publication.

Training. This paper will not provide a complete list of training and specialties required by all who work in an ATS. However, important and unique points to consider will be addressed. Firstly, even those individuals with common trades such as heavy equipment operators need special training to safely operate on the airside. Second, the Air traffic controller, the flight service specialist and other specialized aviation support trades' training is lengthy, expansive and low density in a small country once an initial cadre is established. Therefore, training must be planned well ahead of time, proper resources must be assigned and perhaps subcontracting or resource pooling should be considered.

Regulation. Regulation provides the framework within which the aviation industry can develop and operate in a coherent fashion. The safety and credibility of a nations ATS relies in good part on the quality and application of comprehensive regulations that meet with international standards like ICAO's. A national government

must therefore establish an air transport department or ministry to liaise with ICAO, IATA, FAA and the likes; promulgate laws; and enforce international standards.

Personnel. Personnel is perhaps the most challenging issue in the construction or re-habilitation of an ATS. It spans all functions and requires for the most part, highly skilled workers. Below, is a basic list of trades and specialties that would form the core of a national ATS. This list is not meant to be all inclusive due to the great complexity of aviation and the varying needs based on situation. Further, occupations will be explained only to the level required to attain a basic understanding of their function; hence, some will not require expansion. The first category includes controllers and flight followers. More specifically, as described in the advisory function, flight advisors and flight service specialists provide advisory services to aviators. Controllers on the other hand include aerodrome, ground, arrival, departure, terminal and enroute, and PAR controllers. As well, airspace managers, ATC supervisors, trainers, regulators and flight safety specialists come from the ranks of experienced controllers.

Supporting the backbone of ATS, an army of technicians and engineers from a variety of fields maintain, adapt and develop communications, navigations and surveillance systems. An airport is an ants' nest of activity. It needs experienced leaders, operators and managers to coordinate activities. Most construction trades are used to provide construction, renovation and maintenance to infrastructure; heavy equipment operators are needed for airport surface repair and maintenance; and security patrol the airfield and screen passengers. Often operating on airports, meteorological observers, forecasters and briefers provide all important information to aircrews and controllers.

Flight safety trained personnel from most occupations within the ATS sphere are required, not only to man flight safety system specific positions but, as a presence amongst line-workers to promote this all important function. Finally, experienced personnel are required to provide their expertise in the delivery of training, and to support the development and maintenance of a regulatory system.

A look into the future

Since the 1980s, realizing that the existing air navigation system would not be capable of handling the continued growth in air traffic, ICAO embarked on the study of the Future Air Navigation System (FANS). The report from the initial phase of the project, completed in 1988, confirmed that indeed the current Communication, Navigation, Surveillance (CNS) and Air Traffic Management (ATM) systems would not meet the future needs of aviation.[57] A system that would enable ATS to strive worldwide had to be devised. The CNS/ATM, which, in its simplest expression, consists of a mixture of digital and satellite technology for communication, navigation and surveillance, and sophisticated computer systems to enhance ATM services is seen as the solution.[58]

Already, many of the systems functionalities are being introduced in airspace where immediate economic or safety advantages can be realized. For example, ADS is in use over certain oceanic areas and digital automated terminal information service (D-ATIS) has been introduced in some airports. ICAO has devised long term operational

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[57] *Ibid.*, 3-4.

[58] Michael S. Nolan, *Fundamentals of Air Traffic Control…*, 9-12.

concepts[59] and plans[60] to harmonize this evolution. The important take-away from this is that ATS delivery is in rapid evolution.   While legacy systems remain central to deployed operations, the development of a country's ATS will have to be compatible with evolving technologies.

Part II – Resources

The first part of this paper demonstrated the need for a well-working ATS and the infrastructure that supports it for peacekeeping and post-conflict reconstruction. As well, it defined the structure of this system, what it looks like, and the various components that compose this architecture. As seen, a complete ATS system is complex and involves numerous skills and technologies that only the most advanced economies possess, at least in their entirety. Both components and integration know-how exist for the most part within Canadian society or can be obtained through our allies and partners.

This part of the paper will detail these competencies and those components that Canada could contribute to the development of a solid ATS in a developing country. The number of Non-Governmental Organizations (NGOs), government agencies and corporations of all types that could contribute to the development of an ATS is enormous; it could go from small component manufacturers to large integrators. Hence, the list of organizations under study below will not and could not be all inclusive. Therefore, for the purpose of this paper, we will focus on those better known organizations that offer integrated solutions, and complete systems, infrastructures and services.

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[59] ICAO, *Global Air Traffic Management Operational Concept…*

[60] ICAO, *Global Air Navigation Plan for CNS/ATM Systems* (Montréal: ICAO, 2002).

There is a large number of international organizations that offer and coordinate help to developing countries. Therefore, as we begin our study of Canada's own capabilities, we must first consider and understand the context in terms of resources, finances and regulations that prevail in multinational operations and post-conflict reconstruction. Hence, this next section will examine the available resources beginning with international organizations, followed by Canadian government departments and agencies, and will finish with Canadian industry.

International Organizations

Given the nature and the scale of most peacekeeping and post-conflict reconstruction operations, any Canadian involvement has been multinational in nature. Canada alone is not able to resolve all the problems of a country and, even if it was able to, it is unlikely that it would be desirable. Therefore, as Canadians do in their current multinational operations, they will likely harmonize their contribution within a larger ensemble of other nations. It is through international organizations that help is coordinated and dispensed, and it is with them that a well-meaning country like Canada harmonizes its actions.

Often, if not always, a multinational mission in which Canada would take part, whether it be peacekeeping, peacemaking or post-conflict reconstruction, would be first authorized or prescribed by a UN resolution passed either in the General Assembly or the Security Council. The level of implication of the UN in a mission depends upon its type, resource availability, politics and many more factors. For example, many aspects of the current mission in Afghanistan are under NATO leadership, sanctioned by a UN mandate because, given the muscular effort required, a well-established military organization is

required to ensure mission success. The UN, NATO and the European Union, in turn, led the mission in former Yugoslavia since the early 1990s as the mandate evolved. What is important to retain from this is that the UN is a centerpiece in any multinational operation; coordination at that level is always desirable and usually needed.

Two other UN agencies that are not directly involved in aviation but that might support are the United Nations Development Program (UNDP) and the World Bank. The UNDP provides the UN's global development network. It is interested in connecting countries to knowledge, experience and resources in support of social and economic development.[61] The UNDP has already helped countries such as the UAE to implement projects in the fields of meteorology and civil aviation.[62] Afghanistan as well is currently receiving assistance from UNDP.[63]

While the UNDP aims at offering and developing expertise in the support of projects within a developing nation, the World Bank helps raising the money required to bring initiatives to fruition.[64] It provides loans to promote economic growth in infrastructures. For example, the World Bank was involved in the economic reconstruction of East Timor in 1999. It was chosen to lead a joint assessment mission

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[61] UNDP, "United Nations Development Program – Who We Are & What We Do," http://www.undp.org/about/; Internet; accessed 21 February 2007.

[62] Taghreed Haider, "Enhancing Operational Activities for Development in the UAE," *UNDP New*, January 2003, available at http://www.undp.org/undpnews/pdf/Jan03.pdf; Internet; accessed 20 February 2007, 7.

[63] UN, "United Nations Development Program – Afghanistan," http://www.undp.org.af/-media_room/archives/key_docs/key_docs.htm; Internet; accessed 20 February 2007.

[64] UN, "World Bank," http://www.un.org/Pubs/ourlives/bank.htm; Internet; accessed 21 February 2007.

which assessed East Timor's needs because it has a post-conflict and reconstruction unit, and a post-conflict fund.[65]

International Civil Aviation Organization (ICAO)

According to Michael Carney and Medhi Farashahi in "Transnational Institutions in Developing Countries: The Case for Iranian Civil Aviation", the two sides of the civil aviation coin are the commercial and the technical regime.[66] The commercial regime is represented by the International Aviation Transport Association (IATA) which concerns itself with representing, leading and serving the airline industry. Its membership include 260 airlines worldwide, representing 94 percent of air traffic.[67]

The Convention on International Civil Aviation, signed on 7 December 1944 created ICAO. Representing the other side of the coin in the world of international aviation, ICAO assists governments and the aviation industry in ensuring safe, orderly and efficient worldwide air transport. More specifically, ICAO establishes international standards, and recommends practices and procedures on technical, economic and legal matters within the field of civil aviation.[68] For comparison, IATA could be seen as a lobby group on behalf of the airline industry while ICAO would be like a government agency that must balance the needs and wants of both clients and service providers.

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[65] James Dobbins *et al*, *The UN's Role in Nation-Building From the Congo to Iraq* (Santa Monica: RAND Corporation, 2005), 193.

[66] Michael Carney and Farachahi Medhi, "Transcontinental Institution in Developing Countries: The Case of Iranian Civil Aviation," Organization Studies 27(1): 53-77; http://www.oss.sagepub.com; Internet; accessed 8 January 2007, 57-8.

[67] IATA, "IATA at the Air Transport Industry's Side," http://www.iata.org/about/; Internet; accessed 24 February 2007.

[68] ICAO, "Strategy – Guiding International Civil Aviation into the 21st Century," available from http://www.icao.int/icao/en/pub/strategy.pdf; Internet; accessed 15 December 2006, 1.

At the high level, ICAO is structured in five bureaus: Administration and Services, Air Navigation, Air Transport, Legal Affairs and Technical Co-operation. Four of these divisions are of particular interest to this paper as they provide the technical, procedural, managerial and legal base for the development and maintenance of a globally integrated ATS. The Air Navigation Bureau is concerned with the safety, regularity and efficiency of air navigation. The Air Transport Bureau provides advice on general air transport matters, security concerns, air navigation services and other specialized sub-fields as required. The Legal Bureau advises on constitutional, administrative and procedural matters, on problems of international law, air law, commercial law, labour law, and related matters. Finally, the Technical Bureau assists in project implementation.[69]

ICAO is a key player in the development of ATS and its supporting infrastructure around the world. In addition to its headquarters in Montréal, Canada, ICAO reaches worldwide, in support of the specific mission of each of its bureaus with a network of regional offices in Bangkok, Cairo, Dakar, Lima, Mexico, Nairobi and Paris.[70] Through this network, individual bureau can fulfill the following specific functions in support of post-conflict reconstruction.

The Air Transport Bureau promotes the adoption of ICAO standards through missions, informal meetings and courses. It administers the International Financing Facility for Aviation Safety which provides support to improve aviation safety. As well, it provides coordination with the African Civil Aviation Commission, the Arab Civil

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[69] ICAO, "Bureaux's Activities," http://www.icao.int/icao/en/m_bureaux.html; Internet; accessed 24 February 2007.

[70] ICAO, "Regional Offices," http://www.icao.int/icao/en/m_rao.html; Internet; accessed 24 February 2007.

Aviation Commission, the European Civil Aviation Conference, the Latin American Civil

Aviation Commission, other arms of the UN, and other international organizations.[71]

The Legal Bureau contributes to cooperation and coordination in legal activities

with the UN and other international organizations.[72] Finally, the technical Cooperation

Bureau assists in project implementation in the areas of restructuring, flight operation and

safety, aviation and airport security, CNS/ATM, and in the provision of experts,

equipment and training.[73] For example, governments from 33 countries such as:

Andorra, Bosnia and Herzegovina, Guatemala, Iraq, Panama, Portugal and Liberia have

asked for and received help from the Technical Cooperation Bureau.[74] The bureau helps

with tasks as varied as: airport assessments, rehabilitation, maintenance, upgrading and

expansion; airfield site selection, master planning, financing of new construction, plans

design and review, and overall project supervision; airport inspection to ensure

compliance with standards; personnel assessment and training organization; and security

requirement evaluation.[75]

Already involved in a large number of development projects such as in

Afghanistan, ICAO looks at the 21st century and set a number of strategic objectives

aimed at supporting its mission of safe, orderly and efficient worldwide air transport. Of

the eight supporting objectives it enumerates in its strategic plan, "assisting in the

mobilization of human, technical and financial resources for civil aviation facilities and

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[71] ICAO, "Air Transport Bureau," http://www.icao.int/icao/en/atb/; Internet; accessed 24 February 2007.

[72] ICAO, "Legal Bureau," http://www.icao.int/icao/en/leb/; Internet; accessed 24 February 2007.

[73] ICAO, "TCB Home," http://www.icao.int/icao/en/tcb/; Internet; accessed 24 February 2007.

[74] ICAO Technical Cooperation Bureau, "ICAO Involvement in Airport Projects," available from http://icao.int/icao/en/tcb/Attachements/ICAO%Involvement%20in%20Airport%20Projects.pdf; Internet; accessed 6 January 2007, 3-4.

[75] *Ibid.*

services"[76] is most indicative of ICAO's continued interest and presence in post-conflict

reconstruction through aviation.

Government of Canada

> …[I]t is important to share Canadian expertise with developing or
> emerging nations because Canada, as a developed and highly skilled
> nation, has a certain responsibility to help less-developed nations in the
> world.[77]

As indicated in the introduction, Canada is an aviation country. Its great northern

expanse was developed using aviation and, still today, air transport remains the only

reliable and continuous means of transport that opens its resource rich territory and

provide its citizens with access to the amenities of the south. As an aviation nation,

Canada is in an excellent position to advise other nations in this regard.

Government agencies which are particularly pertinent to this discussion are

Transport Canada, the Department of National Defence (DND), the Department of

Foreign Affairs and International Trade (DFAIT), and the Canadian International

Development Agency (CIDA).

Transport Canada

This country has developed a worldwide reputation for its safety record, even

with its widely varying and treacherous climate, and rugged terrain. This speaks well of

Canada's regulatory framework as developed, maintained and enforced by Transport

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[76] ICAO, "Strategy – Guiding International Civil Aviation …, 9.

[77] Transport Canada, "International Cooperation Program Review"; (May 2003); available from
http://www.tc.ca/programevaluation/reports/internationalcoop/international%20Coop%20Final%20-%20May03.pdf; Internet; accessed 6 January 2007, 4.

Canada.[78] Transport Canada has four operational divisions: air, marine, rail and road,

which can be further divided into directorates. The Civil Aviation Directorate is the most

pertinent in the context of this paper.

The Civil Aviation Directorate sets program contents, policy and standards for the

Canadian aviation sector. It is organized in 12 branches, of which seven apply to this

paper's subject: aerodrome and air navigation, aviation learning services, commercial and

business aviation, general aviation, regulatory services, system safety, and international

aviation and technical programs. The Aerodromes and Air Navigation Branch develops

the regulations and standards applicable to Canadian airports and air navigation, which it

enforces through a number of audits, inspections and monitoring activities. As well, it

develops, implements and improves aerodrome and air navigation program frameworks

and infrastructure.[79] The Aviation Learning Services Branch designs, develops and

delivers training for civil aviation employees. Most interesting, this branch is

increasingly involved in the training of foreign aviation authorities.[80] The Commercial

and Business Aviation Branch is responsible for the safety regulation, inspection and

monitoring of all air operations within Canadian airspace.[81] The General Aviation

Branch is the licensing authority for all pilots and flight engineers; the licensing and

testing standards; and the safety regulations, inspection and monitoring of all Canadian

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[78] Transport Canada, "About Us," http://www.tc.gc.ca/aboutus/menu.htm; Internet; accessed 25 February 2007.

[79] Transport Canada, "Aerodrome and Air Navigation," http://www.tc.gc.ca/CivilAviation/-AerodromeAirNav/menu.htm; Internet; accessed 25 February 2007.

[80] Transport Canada, "Aviation Learning Services," http://www.tc.gc.ca/CivilAviation/-TRAINING/menu.htm; Internet; accessed 25 February 2007.

[81] Transport Canada, "Commercial and Business Aviation," http://www.tc.gc.ca/CivilAviation/-commerce/menu.htm; Internet; accessed 25 February 2007.

flight training units.[82] As well, it regulates aircraft registration and leasing, maintains the

Canadian Aircraft Register, and provides oversight over special flight operations such as

aerial displays and those of unmanned air vehicles. The Regulatory Services Branch

develops legislation, and ensures compliance with the Canadian Aviation Regulation and

the Aeronautics Act.[83] The System Safety Branch identifies and analyses potential safety

issues, provides mitigations strategies, and promotes safety through the sharing of

information.[84]

Finally, the International Aviation Division of the International Aviation and

Technical Programs Branch provides advice and support on international civil aviation

matters. At the technical level, it coordinates the efforts of Transport Canada with ICAO,

other international civil aviation bodies and other departments.[85] To bring it all together

within an integrated ATS re-construction program on behalf of Transport Canada is the

International Cooperation Branch of the Corporate Relations Directorate. This branch

runs the International Cooperation Program which coordinates requests for technical

assistance and promotes Transport Canada's expertise abroad.[86] For example, Transport

Canada sent a former employee to South Africa as an expert on rail safety legislation in

coordination with CIDA in 1999. On the aviation side, it provided a letter of non-

exclusive support to a Canadian infrastructure company helping it obtain a construction

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[82] Transport Canada, "General Aviation," http://www.tc.gc.ca/CivilAviation/general/menu.htm; Internet; accessed 25 February 2007.

[83] Transport Canada, "Regulatory Services," http://www.tc.gc.ca/CivilAviation/RegServ/-menu.htm; Internet; accessed 26 February 2007.

[84] Transport Canada, "System Safety," http://www.tc.gc.ca/CivilAviation/SystemSafety/-menu.htm; Internet; accessed 26 February 2007.

[85] Transport Canada, "International Aviation and Technical Programs," http://www.tc.gc.ca/CivilAviation/International/menu.htm; Internet; accessed 25 February 2007.

[86] Transport Canada, "International Cooperation Program Review…, 1.

contract for a Turkish airport. As well, the International Cooperation Branch has arranged for private sector delegations to foreign countries to showcase Canadian know-how.[87] As the aviation regulation and enforcement authority of a premier developed country, Transport Canada has acquired invaluable expertise in its field. It is wide ranging and complete; its know-how could be beneficial in whole or in part in the reconstruction of a nation's ATS.

Department of National Defence

The Department of National Defence has capabilities in enabling air operations on short notice in austere locations anywhere around the world. 8 Air Communication and Control Squadron (8ACCS) has equipment and personnel able to set-up a complete VFR and IFR airfield anywhere in the world. The many Airfield Engineer Squadrons spread across the country are prepared to build basic airfields and make combat repairs to damaged ATS infrastructure. The rest of the National Defence Department has many other capabilities that could contribute to the immediate support of a multinational deployment and post-conflict reconstruction. These include air traffic control, meteorology, engineering specialties such as building construction and repair, water and sewage treatment, electricity, roads and grounds, and passenger processing among others.

With over 60 000 members in uniforms and more than 80 military occupations, the CF has a long history for its broad contribution to post-conflict reconstruction and multi-national operations. CF members currently contribute their expertise in El Gorah, providing flight following services to a UN mission; as well, military Air Traffic controllers deployed in Mogadishu, Zagreb and Kabul in support of other UN missions,

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[87] *Ibid*, 3.

and many more provide weather, movement and engineering support around the world every day of the year.

8 ACCS is an air deployable self-supporting unit organized to provide tactical communications, air traffic control, navigation aids, airfield facilities and information management system. More specifically, it has portable airfield lighting kits, TACANs, terminal/arrival radars, PARs, control towers, communications equipment, computer systems, satellite ground terminals and mobile operation shelters. In all, it has enough equipment to set-up two austere airfields simultaneously. 8 ACCS has a vast experience with deployments; supporting troops from the Canadian arctic to Bahrain, Kuwait, Australia and Sierra Leone. One point to note, 8 ACCS has the equipment and a nucleus of controllers, technicians and other support personnel, but for most deployments of importance however, 8 ACCS must rely on augmentations from operational units across Canada.[88]

On its air bases, the CF has a number air traffic controllers; navigation aid, communications and information systems technicians; weather observers and briefers; and many more specialists and organizations that have, just like 8 ACCS, supported deployed operations around the world on a multitude of multinational missions in support of air operations. These individuals and their community have developed unique knowledge and understanding of air operations in demanding and stressful environments, which makes them extremely well-suited for the provision of ATS in multinational operations and post-conflict reconstruction, especially before a country's situation is stable and secure enough to allow the deployment of civilians.

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[88] National Defence, "8 Air Communication and Control Squadron," http://www.airforce.forces.gc.ca/8wing/squadron/8accs_e.asp; Internet; accessed 26 February 2007.

Airfield engineers provide rapid runway repair, construction of expeditionary airfields, fire-fighting and aircraft rescue services.[89] Airfield engineers are a critical capability when deploying air assets to austere locations. They re-habilitate and expand airfields after years of neglect or war damage, and ensure its maintenance. As well, the fire-fighting capability they provide is capital to the safe operation of airfields where explosives, ammunition and combat damaged aircraft represent constant danger to human lives.

The CF has a number of specialist occupations in the field of engineering which include but is not limited to building construction and repair, water and sewage treatment, electricity, and roads and ground. All these and more are employed daily in support of deployed operations. Their contribution to ATS in multinational operations and post-conflict reconstruction could be one of infrastructure re-habilitation and upgrade to shelter ATS equipment and personnel, and the provision basic services such as electricity to operate ATS.

There are many dimensions to the ground segment of air transport. The work of air movement squadrons is often lost in the background. However, they fulfill an important part in the process that enables the safe and efficient delivery of passenger and cargo to destination. Traffic technicians operate airheads, pack and prepare air freight, and load and unload aircraft cargo and passengers just like civilians at Canadian airports. The difference is that the military needs its system to effectively deploy and operate in the most austere locations under constant threat.

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[89] National Defence, "Welcome to the Site of the Airfield Engineers," http://www.airforce.forces.gc.ca/airfield_engineers/index_e.asp; Internet; accessed 26 February 2007.

While Transport Canada provides the regulatory framework, the military can offer working solutions at very short notice. It is important to consider as well is the experience with planning and organizing of CF members. While deployed on a mission and providing ATS to ongoing operations, it would be normal for military personnel to start working with local, Canadian, and alliance authorities towards the development of mid to long term solutions which could become part of the whole-of- government approach.

Department of Foreign Affairs and International Trade (DFAIT)

Finally, the Department of Foreign Affairs and International Trade is Canada's doorway to the world. Within the global framework, it promotes Canadian's security, values and culture through its network of embassies, consulates and trade offices, and its participation in multilateral institutions and international treaties. DFAIT should be the focal point in terms of international assistance through the whole-of-government approach.[90] DFAIT has five strategic objectives: projecting Canada to the world, serving Canadians abroad, interpreting the world for Canadians, serving government abroad and forging innovative organizations.

Of these five objectives, three link directly to the coordination and support of a whole-of-government approach within the framework of multinational operations and post-conflict reconstruction. In terms of projecting Canada abroad, DFAIT aims to: increase international awareness of Canada and its values, strengthen rule-based institutions and policy coherence, and promote Canada's global and human security

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[90] DFAIT, "About Foreign Affairs and International Trade Canada," http://www.international.gc.ca/department/about_us-en.asp; Internet; accessed 27 February 2007.

interests, democracy and good governance abroad. As well, it serves Canadians abroad by enhancing Canadian business foreign development effectively manages missions abroad with partners.[91] All this ties-in perfectly with the fulfillment of the Canadian values and interests, and the needs for ATS and its infrastructure in support of multinational operations and post-conflict reconstruction we identified in Part I of this paper. As well, it shows the coordination framework that should exist with DFAIT as a leader.

CIDA is a relatively small federal agency which coordinates the delivery of assistance to developing countries. It administers about 80% of Canada's foreign aid budget;[92] with spending of $4.14 billion in development assistance in 2004-05.[93] CIDA is active in projects such as post-conflict peace-building, and rehabilitation and reconstruction. There were 76 persons on assignment for CIDA in foreign countries working in the field of transport in 2004.[94] Regrettably, the report available did not specify how many of CIDA's projects were linked directly to ATS; except, for its contribution to the World Meteorological Organization.[95]

In all, the Canadian Government has a number of valuable tools to support the development of an ATS in the context of multinational operations and post-conflict reconstruction. Transport Canada has the expertise to help a country developing its legal

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[91] DFAIT, "Connecting Canada to the World – Prosperity, Security, Identity," http://www.international.gc.ca/department/mandate/sppf-en.asp; Internet; accessed 27 February 2007.

[92] CIDA, "About CIDA – FAQ," http://www.acdi-cida.gc.ca/CIDAWEB/acdicida.nsf/En/NIC-5410529-KFT#snav; Internet; accessed 27 February 2007.

[93] CIDA, "Statistical Report on Official Development Assistance – Fiscal Year 2004-2005," available from http://www.acdi-cida.gc.ca/INET/IMAGES.NSF/vLUImages/stats/$file/Stat_rap_04-05.pdf; Internet; accessed 27 February 2007, i.

[94] *Ibid*, 47.

[95] *Ibid*., 5-8.

and procedural framework. The CF are equipped and trained to provide immediate ATS in the remotest areas of the globe. DFAIT is mandated to provide the whole-of-government package and could offer a link-up with Canadian industry. To complete the whole-of-government approach, CIDA can contribute its experience and financial resources.

Canadian Industry

Private Canadian industry has developed a significant expertise in electronics, computer and communications systems, personnel training and infrastructure design, and infrastructure development and operation as they apply to ATS. In the next paragraphs, some of Canada's better known service, equipment and infrastructure providers, those better able to deliver a complete functionality will be introduced.

NavCanada is a private sector corporation mandated to provide Canadians with civil air navigation services. More specifically, it provides air traffic control and flight information services, weather briefings, aeronautical information, airport advisory services and navigational aids.[96] NavCanada employs a large number of specialists in the fields needed to man the ATS that will be presented in Part III of this paper. However, it is not in NavCanada's mandate to deploy controllers overseas and it is widely understood that it is in general short of employees. However, there are two of NavCanada's supporting functions that deserve attention within the scope of this paper: technology solutions and personnel training.

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[96] NavCanada, "About Us," http://www.navcanada.ca/NavCanada.asp?Language=en&Content=ContentDefinitionFiles%5CAboutUs%5Cdefault.xml; Internet; accessed 28 February 2007.

NavCanada develops and integrate technologies that support its Air Navigation System mandate. These technologies cover the whole range of information processing, communication and display systems such as radar displays, controller decision enhancing tools, traffic management optimizers,[97] tower terminal data processing systems and integrated information display systems. All these are available for licensing; NavCanada offers a full service that includes needs analysis, installation, service and training.

ATS specialists, whether they be controllers, meteorologists, technicians or flight service specialists, need training that is offered only at the NavCanada Training Institute (NCTI) in Cornwall Ontario. NCTI has an international training service that offers training in English as a second language, VFR and IFR control, instructional technology, meteorology, and technology.[98]

Definitely, NavCanada can contribute greatly in the development of a nation's ATS. It is actually in the business of training personnel, both Canadians and foreign nationals, in specialties related to ATS and it commercializes its information processing and communications systems.

Another Canadian company, Raytheon Canada produces integrated ATM simulation systems.[99] In fact, it developed the Canadian Automated Air Traffic System (CAATS) until the project was taken over and lead to fruition by NavCanada. Raytheon Canada develops and commercializes complete air traffic simulator suites also. Its

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[97] NavCanada, "Technology Solution – Stand Alone Products," http://www.navcanada.ca/-NavCanada.asp?Language=en&Content=ContentDefinitionFiles\TechnologySolutions\products\StandAlone\default.xml; Internet; accessed 28 February 2007.

[98] NavCanada, "NavCanada Training Institute (NCTI) – International Training Services," http://www.navcanada.ca/NavCanada.asp?Language=en&Content=ContentDefinitionFiles\NCTI\InternationalTraining\default.xml; Internet; accessed 28 February 2007.

[99] Raytheon, "Air Traffic Systems and Simulators," http://www.raytheon.ca/-Air_Traffic_Systems_&_Simulators/index.asp; Internet; accessed 28 February 2007.

systems have already been exported to countries such as Switzerland, Saudi Arabia, Indonesia and China. Raytheon is a potential competitor to NavCanada in the provision ATS systems. A division of Bell Alliant, XWave engineers many critical components of an ATS: aeronautical information, simulation, air navigation monitoring and radar data processing systems; decision support tools; and Datalink Automatic Terminal Information Service (D-ATIS). XWave developed NavCanada's oceanic flight data processing host software and it is NavCanada's prime contractor for the replacement of its old Automated Terminal Information Service (ATIS) by a modern D-ATIS.[100]

In the infrastructure industry, AECON Group is one of Canada's largest builders. Its civil utilities division handles airfields projects, commercial developments, and other of infrastructure projects.[101] It has shown an ability to complete projects in troubled areas such as the now completed main highway project in Israel that it also operates. In the aviation industry, AECON has begun construction on a new airport in Ecuador.[102]

In the infrastructure industry as well, SNC-Lavalin is a world-leader in engineering, facilities construction and operations, and ownership, operation and maintenance of infrastructure. It has offices in Canada and 30 other countries with ongoing projects in about 100 other countries.[103] For example, SNC-Lavalin contributed to the development of an airport on behalf of the Kenyan Government in 1997. The project involved the construction of a runway, taxiways and ramp; all facilities needed for

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[100] XWave, "Defence & Aerospace – Aeronautical Information," http://www.xwave.com/-key_industries/industry.aspx?IdKey=1&IdPage=6; Internet; accessed 28 February 2007.

[101] AECON Group, "AECON Civil & Utilities – ACML," http://www.aecon.com/Civil_Utilities/Aecon_Construction/; Internet; accessed 1 Mars 2007.

[102] AECON Group, "News Release – AECON Reports 2nd Quarter Results," http://www.aecon.com/News_Releases/news08090601.aspx; Internet; accessed 1 Mars 2007.

[103] SNC-Lavalin, "SNC-Lavalin," http://www.snc-lavalin.com/en/; Internet; accessed 1 Mars 2007.

air traffic including: an air terminal, a control tower, an operations centre, a cargo terminal, an electrical substation, a fire station, a potable water supply system and a fire protection system. All facilities required for air traffic control met ICAO standards.[104] A very capable Canadian Corporation, SNC-Lavalin has shown that it possesses all the expertise and experience necessary to the successful completion of large scale aviation infrastructure projects in less developed countries.

An ATS facility operator: ATCO Frontec. ATCO provides runway operation and maintenance, and cargo and passenger handling in many Canadian airports.[105] Of these airports, two are Canadian Military operations: Moose Jaw, Saskatchewan, and Portage, Manitoba. Most interesting however is ATCO Frontec's involvement in the support of deployed military operations. From 2000 to 2003, it provided general camp support to the CF in Bosnia-Herzegovina. Today, at the Kabul International Airport, ATCO Frontec provides camp support, equipment maintenance and engineering support including: runway repair and building works.[106] As well, it provides air traffic control communications systems and passenger terminal information and communications equipment. Another Canadian corporation that could nestle itself very nicely into the development and operation of an ATS in a developing country, ATCO has displayed that it has both experience and expertise in working in developing countries with the military in support of ATS.

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[104] SNC-Lavalin, "Eldoret International Airport," http://www.snc-lavalin.com/en/3_0/3_1.aspx; Internet; accessed 1 March 2007.

[105] ATCO Frontec, "Facilities and Logistics," http://www.atcofrontec.com/-facilities_logistics/airports.asp; Internet; accessed 1 March 2007.

[106] ATCO Frontec, "Facilities and Logistics – Kabul Afghanistan International Airport: Providing Facilities and Service Support to NATO Forces," http://www.atcofrontec.com/shared_projects/-kabul_facilities.asp; Internet; accessed 1 March 2007.

ATS and its supporting infrastructure are the cornerstone of peacekeeping and post-conflict reconstruction. Canada has the know-how, most of the technology, the training organization and the resources to significantly contribute to a developing nation's ATS. It is congruent with Canadian's values and interest to help less fortunate countries in their stabilization and development through a well-orchestrated, whole-of-government approach in a multinational framework. This next part will discuss how this help could take shape.

Part III - A Concerted Effort

In Part I, this paper demonstrated the importance of an ATS in the support of multinational operations and post-conflict reconstruction, and the compatibility of ATS development projects with Canadian core values, interests and know-how. As well, the reader was able to establish an understanding of the task at hand in order to provide ATS by learning about the phases of flight and the functions of ATS as they apply within the scope of this paper. In Part II, the resources - material, human and intellectual - available within the UN and Canadian society required to establish an ATS in the context of multinational operation and post-conflict reconstruction were identified. Canada, as an aviation nation, has the capacity to contribute significantly to the reconstruction of an ATS through its whole-of -government approach.

This part of the paper will bring this all together into a high level approach to the reconstruction of a country's ATS, from entry to exit. It will comprise three sections. First, a generic country called Ausland, where Canada will intervene as part of a multinational contingent, will be presented. This paper uses a generic country instead of an actual case to help keep the development of the scenario along a path that is broad

enough to ensure that pertinent aspects are covered without distracting the reader into a myriad of details. Second, using the ATS functions and the military resources identified at parts I and II respectively, and keeping in mind many of the operational realities of multinational operation with NATO or a coalition partners, the paper will describe the installation of a temporary ATS that supports the response to a crisis. Third, as the situation stabilizes and the local government is able to assume its responsibilities again, a permanent ATS will be devised along the seven functions elaborated in Part I. The end state will be a well-working ATS that enables effective governance, enhances social development, fosters economic growth and supports humanitarian response.

Ausland

Ausland is a landlocked country that became independent after decades of colonialism in 1950. It is square in shape, about 600 km north to south and by 500 km east to west. Ausland has a population of six million, which is generally poor. There were a number of educated people in the country but the social disturbance encouraged many to emigrate. The population is concentrated mostly to the north and the south of the country, on either side of a mountain range that effectively splits the country in two. The mountain chain runs east to west and rises up to an elevation of up to 10 000 feet. Only a few passages exist through these mountains and winter road crossing can be perilous and is always lengthy. There are very few inhabitants in the mountain range; they are regrouped in a few isolated villages.

There are two airports in Ausland, one in the north called Northport and one to the south in the capital city of Southport. Both airfields are unusable by commercial airliners and strategic transport aircraft. The runway's surfaces were cratered during fighting for

their control and all ATS infrastructure and equipment was pillaged and vandalized. The few local controllers have fled and cannot be found. Airports must be reopened quickly to permit the entry and operations of both the Ausland Assistance Force (AAF) and humanitarian aid groups because a humanitarian crisis is looming with winter approaching.

The population of Ausland is ethically homogenous but there has been growing discontent between northerners and southerners because of a perceived economical disparity between the two regions and the lack of presence of the central government in the north. This discontent has spread and caused chaos in the country. The government collapsed and warlords are ripping Ausland of the little it had. At the request of the Ausland government, the UN Security Council passed a resolution under Chapter VI that authorizes a multinational force of 20 000 troops to enter the country, stabilize the situation, and re-establish a legitimate government and the rule of law. Contributing countries such as Canada have met with Ausland authorities and established a road map to a sustainable peace.

Amongst others, a well-working ATS has been identified by both the Ausland government and the military commander tasked with the multinational mission as an essential condition to the country's stabilization and post-conflict reconstruction. For the country, an ATS would ease north-south transit which would enhance commerce, governance and security. For the commander of the AAF, an ATS is absolutely required in support of his campaign plan. Troops and goods must be air transported because of the poor state of the ground transportation system and the risk posed by warlords. As well,

the on-site commander needs rapid and flexible transport to act as a force multiplier that compensates for the small force he has been assigned.

The climate in Ausland is temperate with four well-defined seasons. Rain, snow and fog can be expected depending on the season and place in the country. Therefore, both VFR and IFR services are needed in support of aviation. Runways have never been up to ICAO standards and were damaged; therefore, runway repair is needed to enable stabilization operations. After, a renovation program will be required to develop long term capacity. The rest of the ATS was destroyed or otherwise rendered ineffective; hence, the AAF, which is staffed by 10 NATO countries, has to deploy with its own ATS. Finally, preparation for a follow-on re-construction project must begin when possible.

Temporary ATS

NATO documents now clearly state that it needs to establish its own ATS to run efficient airports within its areas of operations.[107] An ATS is essential to mission success. In light of its experience in Bosnia, Kosovo and Afghanistan, NATO understood how demanding and complex such a task could be.[108] Still, given the importance of an ATS, not only to support the multinational operations, but to promote post-conflict reconstruction, Canada decided to support military and humanitarian operations during the early stages of this crisis by providing the AAF with a temporary military ATS on one airfield, Southport, while NATO as an organization will provide ATS in Northport. After several years of different budgetary and foreign policy priorities, including a reduction of more than fifty percent to its Air Force personnel, the CF does not have the human

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[107] NATO, *NATO Handbook* (Brussels, Belgium: Public Diplomacy Division, 2006), 283.

[108] NATO, *NATO Air Traffic Management Committee (NATMC) – Principles and Elements for a NATO Deployable ATM Component* (Brussels, Belgium: NATO, 2004), 1.

resources to operated two airports simultaneously. When it comes time to establish

Ausland's permanent ATS, Canada, in collaboration with ICAO and the host nation, will

support the Ausland government in reconstructing its own civilian ATS.

To define the ATS during this initial and temporary phase of the mission, when

the AAF provides all ATS for the country, four of the seven previously identified ATS

functions will be used: airport, ATC, meteorology and flight safety. The personnel,

training and regulation functions are normally handled by the nations contributing air

assets as part of the force generating process. This is normally done at home on a

continuous basis, and will not be considered until the reconstruction phase. As indicated

before, during this first phase, Canada would take responsibility for the Southport

airfield, which needs surface repairs and complete aerodrome services. Canadian airfield

engineers, as well as other construction-related occupations of the CF, would employ

themselves in the repair of runways, taxiways, ramps and any building that could be of

use. As well, airfield engineers would re-habilitate salvageable services such as water,

sewers and electricity; thus, enabling airfield operations. With the initial repairs

complete, the number of engineers could be reduced to the quantity required to the

maintenance of the operations. Meanwhile, the airport operations cell would begin to

coordinate the development and organization of the airfield's other functions, and ensure

the smooth day-to-day operation.

As repairs progress on the airfield, 8 ACCS would begin the installation of

runway and taxiway lighting, mobile tower for VFR control, radar control units for IFR

control, which includes PAR, and a number of navigation aids including TACAN and

NDB to enable IFR navigation and approach. As well, radios, SATCOM and land-lines

would be set-up to provide the communications backbone for the control of airplanes and the operation of the airfield. On behalf of the AAF, 8 ACCS would negotiate, either directly or indirectly, a number of unit-level coordination agreements with the host nation, neighboring countries and other parties on matters pertaining to the tactical coordination of air traffic movements and airspace management. As will be explained below, a higher level military organization, the joint air operation center (JAOC) might be involved in airspace organization and coordination. Still, it remains that 8 ACCS will be required to conduct lateral and vertical coordination. As well, 8 ACCS would develop instrument approaches (IFR), departure procedures and, perhaps, a rudimentary airway structure if needed.

As the airports get ready for operation, fire and rescue systems commensurate to the type of aircraft and the level of risk accepted by the commander would be established. As well, a basic air movement unit would be set up to handle cargo and passengers. With loading equipment, and temporary warehouses and terminal buildings, air movements specialists would ensure the reception and dispatch of goods and people. Finally, a rudimentary security function would be established. This security function would not meet the level of sophistication seen in North America. Most likely, the security apparatus would focus on the protection of the airport's perimeter, to prevent intrusions and attacks.

Once 8 ACCS' equipment would be set-up, a number of CF ATC would begin to arrive to undertake local acclimatizing and facility rating. Controllers would include aerodrome, ground, terminal and PAR controllers. As well, it is possible that flight advisors be employed should traffic density, service criticality or personnel availability

force the operation of the airport as a flight advisory only during certain hours; thus, reducing the number of controllers required.

One significant difference between the model showed in Part I and what could be seen in the early days of a crisis response within the context of a multinational force pertains to the operational level handling of traffic flow and synchronization, airspace management, flight planning and aeronautical information. When operations involve a large number of military air assets as seen in Afghanistan or during the Kosovo Campaign for instance, a JAOC is set-up. A JAOC is a military structure that coordinates all efforts linked to the planning and employment of air power employed in support of an operation in an area of operation. Amongst others things, a JAOC publishes the air tasking order, which is a detailed daily flight schedule, the air control order and the airspace control plan, which establish the procedures and airspace control measures in effect. As well, the JAOC coordinates search and rescue and may provide some meteorological information.[109] To this effect, any aircraft flying to or from Ausland would seek clearance and be controlled by the JAOC or one of its subset before coming under the control of 8 ACCS. The JAOC's intervention would be in the aircraft's planning, cruise and, perhaps, collection phases of flight. In addition, most of the initial airway structure could be developed at the JAOC by a team of ATS specialists; thus reducing 8 ACCS's workload.

As ATC gets organized, so would the meteorological section. Most likely this section would be comprised of observers and briefers with reach-back capacity in Canada or the ASOC for complete forecasting. Flight safety, the final element of this

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[109] United States, Joint Chiefs of Staff, *Joint Publication 3-30 – Command and Control for Joint Air Operations* (Washington, DC: U.S. Government Printing Office, June 5, 2003), II-6.

expeditionary system, would be as it is here in Canada, integral to all airfield functions. Possibly, an officer or a cell of officers and non-commissioned members, depending on the size of the air element, would be responsible for coordinating the flight safety program in such a theatre. The flight safety officer would be fed information by the various flight safety representatives to follow trends and make recommendations. As well, he could reach-back in Canada should there be an accident to investigate that fell within his purview.

This was a high level view of a simple organization made of well trained and highly qualified people that would provide basic interim ATS until a permanent solution could be established. By now, the Ausland interim ATS solution enables the operations of tens of aircraft every day. Large transport planes fly-in troops and supplies that support the stabilization operations. These troops and supplies can now be transferred into smaller tactical airlift planes and helicopters that open up the far reaches of Ausland. The UN and other NGOs enjoy renewed rapid and safe access to the country; the mountain range is no longer the obstacle it was. Lastly, but most important, the government can better proceed with the reconstruction Ausland. The catalyst effect of aviation enhances the security environment by enabling responsive observation, and the rapid and flexible dispatch of troops and aid. The government can travel safely and efficiently to affect situations thus enhancing governance. Travel and commerce are made easier, which contributes to the improvement of a national identity. Now, the military, NGOs and the Ausland government can better react to humanitarian situations.

Development and Reconstruction of a National ATS

Building on the initial capability it has developed, the deployable ATS should begin to prepare its exit as soon as possible. As the situation stabilizes in Ausland and the legitimate government is able to assume normal functions, the operational emphasis of the international effort shifts from establishing security and stability to post-conflict reconstruction. A transition plan must be devised with intermediate milestones leading to the transfer of the responsibility of a national ATS to the host nation, in this case Ausland.[110] It is now that all the resources and processes identified in this paper will come together to formulate a permanent ATS that complies with ICAO's standards and recommended practices (SARPs).

In summary, the whole of Canadian government will lead the reconstruction of a sustainable Ausland ATS. Given the poor state of Ausland's infrastructure and the absence of a cadre of ATS specialists to develop and sustain it, the process of handing over this complete and modern ATS will be lengthy, most likely many years in the making, and phased. First, the country will have to secure funds, possibly, through a donor conference, and formally define its requirements and formulate its action plan with support from ICAO, the Canadian government and other interested parties. After, personnel training and infrastructure development will have to proceed with a view to a phased operational acceptance. For example, military and newly minted Ausland controllers may work side by side at a specific units until Ausland has enough of hits own controllers to assume its full control. Then, formal transfer for the responsibility of control provided by this unit could be affected. Similarly, the other functions of ATS

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[110] NATO, *NATO Air Traffic Management Committee (NATMC) – Principles …*, 9.

will be passed from the AAF to the Ausland government in whole or in part, depending on the readiness of the nascent Ausland ATS. The coming paragraphs will emphasize the development of this ATS through the previously identified seven ATS functions: airport, ATC, meteorology, flight safety, personnel, training and regulation. It will remain high level, avoiding getting too low into the weeds, to provide a better understanding of the overall effort and result sought.

At the start point of this phase, airports have been returned to basic serviceability. However, their surfaces have been repaired temporarily only. Airport lighting is temporary, building and infrastructure are not up to commercial standards. The country doe not have yet any of the equipment or personnel required to provide ATS. It does not have the resources to support training and certification in any of the ATS specialties either. At the political level, the Ausland government reorganized itself, creating a Transport Ministry, which is responsible for the reconstruction of Ausland's aviation sector.

The Ausland Transport Ministry, in concert with the UNDP, the World Bank, ICAO, AAF, Transport Canada's International Cooperation Branch, CIDA and the CF representative on site prepare the complete Ausland ATS reconstruction plan. With a holistic view, this plan considers all seven ATS functions, integrates the many requirements in a prioritized list of tasks that best meets Ausland's needs. For the purpose of this paper however, only the resources to rebuild the ATS, using the seven functions will be detailed.

Airport.   Once specific Ausland airports surfaces, lighting, buildings and services specifications would be developed, companies such as SNC-Lavalin and AECON Group

would be able to develop blue prints, perhaps financing options, and start construction.

Good infrastructure is important but, first and foremost, it is the personnel to operate

these airports that will turn them into functional systems. For this reason, in the interim

at least, a company like ATCO Frontec could come in and provide the various functions

required to the smooth operation of airports. It could hire a mix of Ausland nationals and

Canadian employees. That mix could be adjusted to promote local employment as people

from Ausland get trained and certified to work on an airport. This could be quite

effective in developing a trained and experienced cadre of airport operators. This would

give Ausland the option of either keeping its airport's operations under contract or

nationalize them once it is ready.

ATC. By the time reconstruction begins, a temporary ATS has been in operations

for months or years, and the many sub-functions of ATC, which include: advisory,

separation/control, traffic flow and synchronization, airspace management, flight

planning, aeronautical information, and communication, navigation and surveillance have

been assumed by the AAF or higher headquarters. The general structure of a

reconstructed ATC system would quite possibly resemble the temporary apparatus 8

ACCS and the JAOC had set in place. The main difference would be the creation of a

permanent structure, more focused towards national requirements and commercial

operations. More civilian compatible NAVAIDs such as ILS and VOR/DMEs would

become available to re-enforce the navigation system, and the use of VHF radios would

become more prominent than UHF.

In terms of equipment, a number of Canadian firms can provide either the

hardware or the integration know-how, or both. NavCanada, as the Canadian ATS

provider and systems integrator, could be a central player in the reconstruction of the communication, navigation and surveillance system. In partnership with Raytheon, Bell Alliant, DFAIT and CIDA, NavCanada would be in a very good position to lead the re-tooling and integration of the Ausland ATS. Any capabilities or equipment unavailable within the Canadian industry could be handled by international partners such as the parent corporation of Raytheon Canada.

As an aside for the reader's benefit, it is important to know that Ausland would have alternatives to the training of its own national cadre of ATS specialists. There are international firms such as Serco that offer integrated ATS solutions. For example, Serco offers air traffic control services that span all 10 phases of flight; more specifically: area/en-route, terminal and aerodrome control, aeronautical information services, aeronautical telecommunication and engineering services, and training in these disciplines.[111] Such firms were not included in Part II as they are not Canadian; hence, they fall outside the scope of this paper. However, it is important to know that such resources exist and may compete with a Canadian desire to export its know-how.

Meteorology. A number of weather observation stations both at airports and in "strategic" locations should be developed. These weather observation stations, either automatic or manned would feed into one central forecasting office. Weather products would be disseminated through the communication backbone to end users such as controllers, pilots and the public at large. Here again, NavCanada could prove to be a good system integrator.

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[111] Serco, "Serco-IAL (Aviation)," http://www.serco.co.uk/text/middleeast/businesses-/aviation/index.asp; Internet; accessed 29 March 2007.

Flight safety. Flight safety is an important function that often tends to be overlooked in developing countries as demonstrated by their relatively poor air accident record. A nation's ATS needs a flight safety structure that raises airmen's safety conscience and acts as a focal point for flight safety policies. The flight safety system must expand its roots down to the operators and all the way up to the highest instances of the government. This will ensure a complete and integrated flight safety policy that does not overlook any significant aspects. At the national level, the flight safety organization would reside at the Ausland Ministry of Transport. The exact size and shape of this organization would be commensurate to the nation's means and desire to build and maintain a culture of aviation safety.

Training. The training of the personnel required to the operation of a safe, orderly and expeditious ATS is a long and involved process. Usually, it involves a period of schooling that is followed by an operational certification. A controller, for instance, may take up to two years to gain an initial certification status, sometimes more. After, it takes months to become confident enough to supervise controllers under training and it takes years to get the experience level sufficient to reach supervisory levels. As well, as indicated in Part I, the language of aviation is English. Therefore, before controllers begin their training, many might require ESL certification.

It takes years to develop a cadre of individuals that could train controllers, flight service specialists, meteorologists and technicians. As well, the development and sustainment of a training facility is very onerous and could be unachievable to a smaller country. For this reason, even in the long-term, the Ausland government would most likely contract-out the training of most of its ATS personnel. NavCanada would be an

excellent choice for the training of Ausland ATS personnel, both in the short and long-term. Through its international training service, NavCanada's Training Institute offers a whole range of courses in the fields of air traffic control, flight services, meteorology, NAVAID and communications repair and maintenance, and ESL. Financing for the course as for any other Canadian help could be secured by the Ausland government with donor countries or CIDA.

General training in areas such as administration, finance, security, heavy equipment operation, engineering and maintenance can usually be obtained in non-ATS training institutions. It would be reasonable to expect that such capability remain in the Ausland society. This said, for high ranking officers of the Ausland ministry of transport and ATS managers, Concordia University's John Molson Scholl of Business in Montréal in partnership with IATA offers a MBA Aviation that would provide valuable training indeed.[112] Other specialized very low density training in the support of aviation can be obtained from or through ICAO or Canada. For instance, Transport Canada's System Safety Branch could help with training in flight safety. Other branches, could contribute in their area of expertise as well. The CF, also, has a vibrant flight safety program and offers both basic and advanced flight safety courses to its own members. In fact, the CF trains with internal resources its personnel in almost all disciplines, including ATC technical trades. CF members are currently training members of the Afghan National Army and could provide valuable training in support of the Ausland ATS as well.

Regulation. Regulation would be the Ministry of Transport's responsibility just as it is in Canada. ICAO is experienced with helping countries develop their own

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[112] Concordia University, John Molson School of Business, "Graduate Programs in Aviation Management," available from http://johnmolson.concordia.ca/amba/pdf/brochure.pdf; Internet; accessed 31 March 2007.

regulation framework and it has a compete library of publications on the regulation of ATS. Transport Canada through a technical assistance team could also contribute to the development of Ausland's ATS regulation framework.

Personnel. The personnel function will be the most challenging part of the Ausland ATS reconstruction process. Buildings, runways and NAVAIDs can be built and made ready for operations in months or a few years. As became obvious in the training segment above, personnel management requires a long-term view. This section will not repeat what was written in Part I about personnel but will rather push this a step further in the development of Ausland's ATS. Initially, it is quite certain that there would be an acute shortage of personnel of all specialties. As time passes and training is administered, the shortage should diminish, firstly in occupations requiring fewer skills.

To bridge the gap between the time the interim ATS should leave and a permanent ATS solution is functional, four options are available: accept a substantial reduction in ATS, hire foreign specialists, extend the mission of military ATS through a phased exit, or use contracted ATS providers. Accepting a reduction in ATS could set back the country quite significantly in terms of its development, and could even jeopardize its stability by reducing the presence of the government and its ability to respond to its citizen's needs. Hiring specialists has been done by numerous countries in the past; for instance, New Zealand, Australia and the UAE have hired Canadian aviators and ATCs. However, there is quite a difference between these countries and a nation in post-conflict reconstruction. Therefore, it is possible that few specialists would be interested unless they had emigrated and longed to return.

The extension of the military aid is possibly the most appealing solution to the Ausland government, as long as foreign militaries are welcomed by the population. However, as stated in the publication "Principles and Elements for a NATO Deployable Air Traffic Management (ATM) Component," [113] it is essential to limit ATS deployment to the minimum time required. As well, Canada's military, as many others, is very resource limited. Therefore, it is possible, especially if other missions of higher priority comes-up, that Canada had to keep its military contribution to the short-term. Quite possibly the most advantageous transition solution between military ATS and an entirely national system could be the contracting of parts of the ATS. As indicated before, ATCO Frontec can provide airport operations services just about anywhere in the world. Similarly, through CIDA, Transport Canada could provide long term relief through technical assistance. Finally, contractors like Serco can provide services as well.

In all, the reconstruction of the Ausland ATS is doable and a vibrant aviation industry could emerge. As was demonstrated above, the complete and detailed structure of an ATS is extremely complex and influenced by a number of variables. A concerted and long term international involvement would be needed to the reconstruction of the Ausland ATS. Nevertheless, a modern well-working ATS is not only a nice to do but a critical cornerstone of the stabilization and reconstruction of Ausland. After the intervention, the emerging Ausland aviation industry should generate employment, open the country to the world, enable better internal communications and governance, and improve the feeling of unity among citizens.

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[113] NATO, *NATO Air Traffic Management Committee (NATMC) – Principles …*, 1.

Conclusion

From its early days, aviation has been seen as an instrument that shortens distances and brings people closer. The British Empire used aviation to maintain closer links with far away colonies. Today, air transport is seen as a critical element to the integration and continued growth of many countries within the global economy. A vital communication link, aviation provides as a way to unite citizens in countries like Afghanistan where distances, rough terrain and tribalism conspire to split societies. Aviation is a cornerstone of multinational operations and post-conflict reconstruction. It provides the safest, fastest and most responsive means to transport relief supplies, troops and equipment in theatres of operations that often have degraded ground transportation infrastructure, challenging topographical features or are plagued by road-side attacks. Once under attack, aviation enables observation and the flexible application of force.

As a basic enabler to aviation, a modern air traffic system (ATS) is essential to the continuing economic and social development of countries; especially those whose access might be complicated by geographical features. An ATS is also needed for the effective and safe employment of air power. NATO and other partner nations are among the world's prominent conduits for military and humanitarian response in the context of peace-keeping, peace-making and post-conflict reconstruction. In this context, an ATS is a key pillar of aviation as it enables rapid and flexible projection of troops anywhere and almost anytime. This force-multiplying characteristic increases the effectiveness of deployed contingents thus potentially enabling the reduction of their footprint. Recognizing the essential nature of a safe and effective ATS in ensuring operational

effectiveness, NATO is, in fact, currently addressing its past shortcoming by developing an enhanced deployable ATS capability.

As a rapid and long-range transportation means, aviation renders accessible the remotest areas of the globe, thus enabling the spread of commerce and culture in its farthest reaches. This permits otherwise isolated lands to export high value for weight production. As well, aviation brings tourists, discoverers and journalists who spread wealth around the world and increase the global consciousness about situations and crises. Without this global consciousness, our global village would not exist and more humanitarian issues could remain unknown and unaddressed.

A modern ATS is a complex, highly technological and far reaching structure that enables not only the connection of a nation within itself but inter-connects nations and continents together. Such a system must afford the highest standards of safety and efficiency to be viable and to support national objectives. For that purpose, a well trained and equipped core of air traffic services specialists, modern and reliable infrastructure, and a solid regulatory framework are needed. Those must be subjected to a high level of standardization to provide the required compatibility over large expanses and varied cultures. These requirements may place an unbearable burden on countries that have been weakened by years of conflict or economic distress. ICAO plays an important role in the setting and implementation of standards and recommended practices. ICAO and richer nations understand that many countries do not possess the economic, human or technological resources to develop an advanced ATS.

Canada is an aviation nation that has a mature ATS. From the early days of flight, it has learned to develop and operate aircraft and ATS which, even in our treacherous

northern climate, are among the safest and most efficient in the world. Canada is also a rich nation with great ideals that holds a worldwide reputation for its humanitarian involvement. In concert with international organizations such as ICAO, Canada has the capacity to deliver a significant contribution to a country's ATS in the context of multi-national operations and post-conflict reconstruction through a whole-of-government approach.

In a two-phased approach, Canada could first support the rapid deployment of both troops and humanitarian aid with its deployable military ATS capability. This approach, which is not only beneficial to the host nation, would also capitalize on one of this country's strengths, its aerospace expertise. As well, it would offer a different avenue for its military intervention, an approach which is perhaps more compliant with some internal political priorities while still offering a significant contribution to a coalition. As the situation improves, Foreign Affairs, Transport Canada, CIDA and Canadian industry supported by a still present military could contribute to the development of permanent ATS components that include the seven operational functions of ATS as they apply within the scope of this paper: airport, ATC, meteorology, flight safety, personnel, training and regulation.

In the past, Canada provided small numbers of military of air traffic controllers, meteorological observers and many more specialists from the aviation field in support of a variety of UN and NATO operations. From what I observed from my experience in Kabul, the need is great, and Canadian participation is sought after and well-appreciated. As well, components of its government and industry have contributed to the development and construction of vital long-term air transportation solutions in many different areas.

Canada has the capability and opportunity, through its whole-of- government approach, to focus its efforts and offer complete ATS solutions in support of multinational operations and post-conflict reconstruction around the world.

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