Table of Contents

Appendices

List of Figures

Page

List of Tables

Page

1. Introduction

1.1 Study Background

The Government of the Northwest Territories (GNWT), through the Northwest Territories Department of Transportation (the Department), owns and operates fifty-two public airports as part of its mission to provide for safe, accessible and reliable movement of people and goods throughout the North. These airports form an integrated system of local community and regional facilities that link the region from east to west as well as to points in southern Canada.

The role of the NWT's airport system is crucial in preserving the livelihood of the region's population. For many communities, these airports constitute the only year-round means of access and, in some instances, support a number of regional economic activities such as mining and resource exploration. The Department recognizes this role through the policies under which airport facilities are operated. The fundamental standard governing the level of facilities to be provided is the Department's Airport Classification system. Originating from the 1974 Federal "Policy for Provision of Air transportation Facilities and Services in the Yukon and Northwest Territories", the Classification system has been augmented by a Classification Index to provide a numerical rating derived from weighted factors relating to the site characteristics and activity. By assignment to one of four classifications, airports qualify for a given standard of facilities, including runways, communications/navigation aids and passenger terminal/shelters.

Regardless of specific airport designations, however, many communities and air carriers have requested that improvements be made to existing airport infrastructure. These requests range from runway resurfacing to airport relocation projects with a number of projects involving runway extensions. These requests are made with the expectation that economic gains will be made, that service improvements will be obtained, or that regulatory compliance will be achieved.

> **Many communities have requested improvements to their airports, but annual funding is limited and cannot accommodate all requests.**

The Department assesses these requirements based on three capital expenditure guidelines. The first guideline is to ensure that existing infrastructure is maintained for safety; the second is to upgrade facilities to meet certification and operational standards; and the third priority is to upgrade or expand facilities to accommodate air traffic growth. Based on these guidelines, improvements to airside facilities should typically be preferred to airport facility enhancements.

Over the past few years, several facility improvements have been completed. Unfortunately, expected benefits have not often accrued in a number of cases. Today, with roughly $9 million available annually for capital projects, the Department cannot respond to all the requirements identified by community leaders and air carriers. Although the Department recognizes the validity of many requests, annual funding is only sufficient to maintain the airport facilities already in place. In light of these conditions, the Department has undertaken to improve, through this study, the process upon which airport capital expenditure decisions are made.

1.2 Objectives

The purpose of this study is to review current and future runway requirements over a 20 year horizon at GNWT operated airports, and to propose a methodology for the evaluation and prioritization of runway extension requests and related proposals.

The study's specific objectives are the following:

- Assess the level of service provided by the existing air service network;
- Project the development of future northern air service system from traffic forecasts, market trends, and developing technologies;
- Review the GNWT Airport Classification System and airport planning methods;
- Identify air service indicators that measure potential service levels at existing facilities; and
- Compare the operational capability of each airport to that required to support operations by aircraft types consistent with existing and future air service demand.

This study is intended to improve the process by which airport capital expenditures are made.

1.3 Approach and Methodology

The Department views the airports it operates as an integrated system rather than a group of individual sites. As such, the study adopts a systems approach that assesses the factors that influence the structure of the air service system as a whole. These factors include the economic and political conditions that influence demand and service levels, and the regulatory environment that defines facility requirements.

The methodology undertaken to achieve the study's objectives involves the assessment of current system characteristics, the projection of the future air service system structure, the development of a site assessment methodology and the identification of the runway infrastructure required to accommodate future air service demand.

The assessment of the current system characteristics is performed on the basis of data review and stakeholder consultations. Data review is undertaken to identify current service levels, market demand, economic trends, regulatory environments and policy guidelines. Stakeholder input is obtained to identify local concerns and needs as well as industry requirements.

The projection of the future air service system structure is performed through an analysis of the factors that are expected to influence the supply/demand for air services in the North. A review of passenger and cargo traffic statistics serve as a basis to this analysis.

The site assessment methodology is developed through a review of current airport classification systems and airport planning requirements for northern airports. The definition of air service indicators provides essential input to the methodology developed.

The runway infrastructure requirements for the 52 GNWT airports are identified through the application of the proposed methodology.

1.4 Assumptions

The development of the future air service structure in the North will depend on a number of factors. Since economics, governance, technologies and aeronautical regulations play a large role in defining system requirements, the assessments and requirements evaluations made in this study have been based on the assumptions described below.

The future development of the northern air service system is expected to be market driven, and the economic rational of air services in the NWT will take greater importance as the effects of deregulation are incurred. It is expected that the relationship between the size and type of aircraft serving a community, the number of flights, quality and level of service, and the cost of passenger and cargo traffic will be become, therefore, more and more interdependent.

Changes to the political structure of the Northwest Territories, notably with the creation of Nunavut, are expected to bring changes to air traffic patterns in the North.

The study considers that:

Future air service development in the NWT is likely to be largely market driven.

The creation of Nunavut is expected to bring forth some changes to the air traffic pattern.

Many existing aircraft will become obsolete or uneconomic during the next 20 years

New aeronautical regulations will influence runway requirements.

Many of the aircraft currently operating in the North will become uneconomic or obsolete over the next 20 years. It is expected that these aircraft will be replaced by more modern and, in some cases, more demanding equipment that may create new system requirements.

The implementation of new aeronautic regulations by Transport Canada – notably the Canadian Aviation Regulations (CARS) – is expected to influence runway length requirements for certain aircraft. These requirements may have impact upon the level of air services provided to a number of communities if certain improvements aren't made to existing facilities.

1.5 Report Content

This report contains eight sections, an Executive Summary and 12 appendices. The sections are organized as follows:

- Section 1 outlines the background, objectives, methodology and assumptions.
- Section 2 traces a portrait of the existing air service system in the Northwest Territories.
- Section 3 offers insight to stakeholder concerns regarding current air services and airport facilities.
- Section 4 addresses the issues that will influence future air service demand/supply in the North.
- Section 5 attempts to define the basic structure of the future system.
- Section 6 assesses airport system planning processes and proposes a decision-making method for capital project prioritization.
- Section 7 provides an assessment of current site requirements based on the methodology developed earlier.
- Section 8 provides a summary of study recommendations and observations.

Note that, since runway lengths and widths are published for aviation purposes in feet, imperial measures are used in this report for runway measurements. Metric units are used for all other purposes.

2. Existing NWT Air Services

The Northwest Territories are served by an extensive air transportation network that links the region from east to west and to points in the south. Unlike other Canadian regions, the NWT are largely dependent on air services because of the relatively small size and remoteness of most communities. While this dependency dictates the need for air services, demand and travel patterns are influenced by prevailing local and regional economic conditions, political environments and the regional linkages that these factors create. Together, these conditions structure the northern air service system.

Calm Air, Canadian North (a subsidiary of Canadian Airlines), First Air, NWT Air (a subsidiary of First Air) and numerous feeder airlines currently provide scheduled and charter air services throughout the NWT. These services consist of passenger, cargo, and medevac operations. The following section will take a closer look at the components that characterize the current air service system in the NWT.

2.1 Scheduled Carrier Operations

Scheduled air services are provided to 47 of the 52 airports owned and operated by the Government of the Northwest Territories.[i] The scheduled flights that are operated between these airports provide a structure for the existing air service system via an integrated network of trunk and feeder lines. The trunk lines link the northern air service hubs to each other and provide access to and from points in the south. The feeder lines link smaller community airports to the airports served by the trunk routes. This network generally resembles the hub and spoke system that exists in southern Canada. Figure 2.1 illustrates the current air service route structure in the NWT. Detailed route structure information is provided in Appendix 1.

Scheduled air services are provided to 47 of the 52 airports owned and operated by the Government of the Northwest Territories.

2.1.1 Trunk Routes

With minor exceptions, trunk lines typically link the airports located in each regional administrative centre. These airports are critical components of the northern air transportation system as they serve as anchors for the entire network. Specifically, these airports provide gateway access to the South or serve as a staging point for air routes between regions.

Trunk lines typically link the airports located in each regional administrative centre

The existing trunk network is built from the main air service route corridors that cross the region. The first corridors comprise the main north/south routes that link the NWT air service hubs to hubs in southern Canada. The north/south routes are; Yellowknife – Edmonton; Rankin Inlet – Winnipeg; and Iqaluit – Montreal/Ottawa. The second, the East/West corridor, runs across the southern portion of the NWT linking Yellowknife, Rankin Inlet and Iqaluit. The third corridor consists of the main routes that link the northernmost regional centres to those located along the main East/West corridor. These routes are: Yellowknife – Norman Wells – Inuvik; Yellowknife – Cambridge Bay – Resolute; and Iqaluit – Resolute.

North/south trunk routes provide the greatest amount of capacity. These services are operated by the larger airlines with jet aircraft, either the B727 or B737. These airlines also have services beyond the three primary gateways to the other regional hubs and community airports with smaller-sized equipment, generally turboprop aircraft.

The winter operations of the trunk carriers involve some 91 weekly northbound flight cycles. These routes often include numerous en-route stops - from two to five. There are an equal number of flights southbound for an overall total of 182 weekly flights. Summer operations on trunk routes involve a minor increase in flight frequency with minimal change to the routing patterns. Increased seat capacity requirements can often be handled by adjustment of the seat configuration in the many different combination aircraft operated in the region.

2.1.2 Gateway Air Services

The gateway air services are provided through non-stop jet service between the Northern gateway hubs – Yellowknife, Rankin Inlet and Iqaluit – and the Southern hubs mentioned earlier. Table 2.1 summarizes the service provided between these points for the winter 1997/98 season:

Table 2.1
Gateway Weekly Air Services
Winter 1997/98

Region	Service	Weekly One-way Flights
Western NWT	Yellowknife-Edmonton	59
Central NWT	Rankin Inlet - Winnipeg	10
Eastern NWT	Iqaluit – Montreal/Ottawa	13

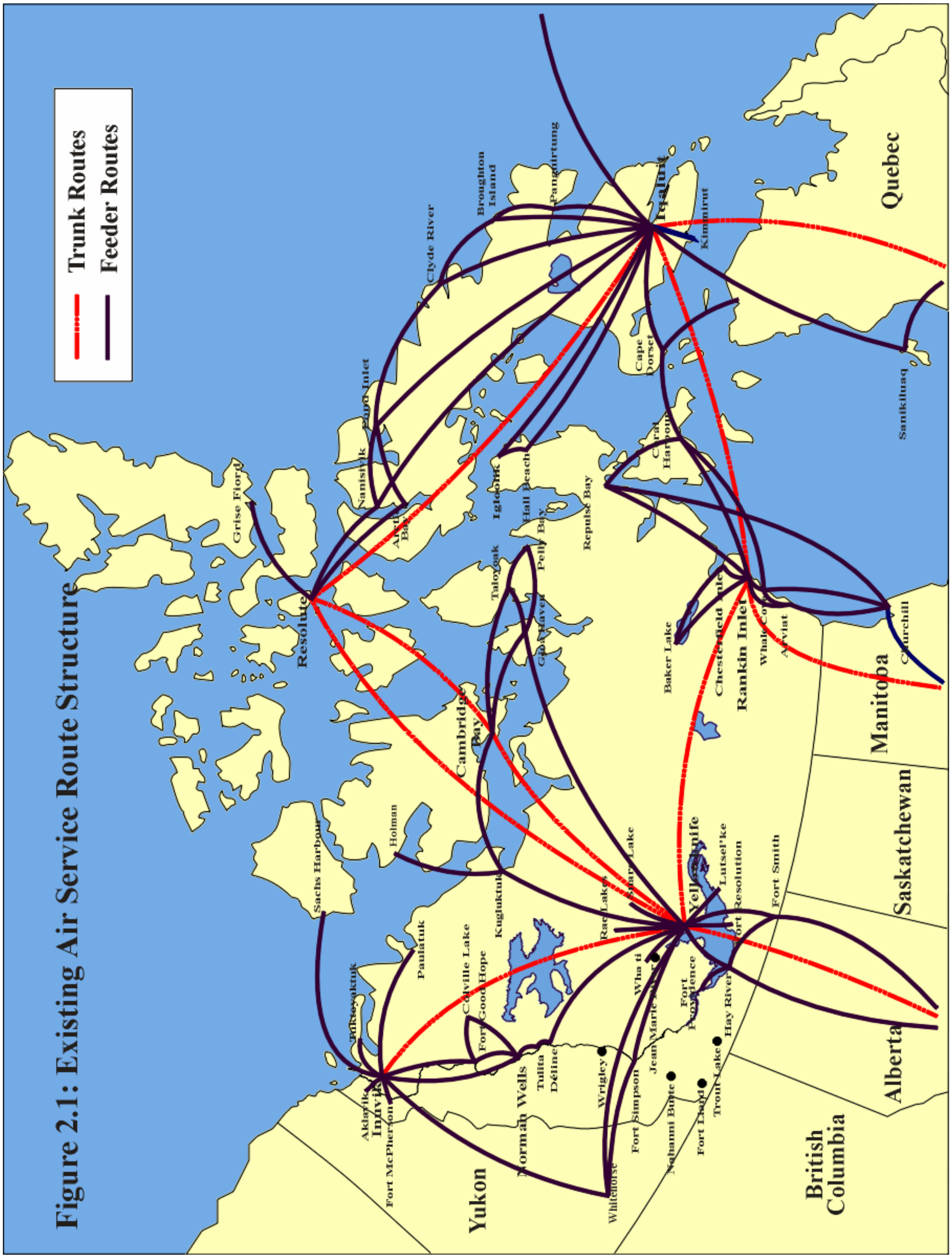


Figure 2.1: Existing Air Service Route Structure

2.1.3 Feeder Air Routes

Feeder routes are typically those that link smaller communities to the hub airports located along the main trunk lines. In many cases, because of the relatively small size of most of the communities served, air service along specific routes is usually less frequent, but as reliable, than that available between the hub airports. A number of air carriers currently provide service between most northern communities and a regional hub. Regional flights are generally provided by the carriers that provide service along the trunk lines. Local flights are provided by a number of smaller regional carriers. In both cases, feeder routes are usually serviced with turboprop aircraft ranging from the Beach-99 to the larger HS748. While the larger scheduled carriers play an important role in maintaining the integrity of the overall air transportation system, the regional and local carriers play an important role in maintaining the livelihood of many small communities. Because of the current levels of local demand in many communities, however, jet service is rarely considered economically viable on most routes.

Feeder routes are typically those that link smaller communities to the hub airports located along the main trunk lines

2.2 Charter Services

Charter air services are widely available throughout the NWT, and are used to augment existing passenger and cargo service in most communities. Most northern scheduled carriers provide charter service on demand, but a number of small private operators also provide service in some regions. These services also support mining, gas and oil industries by providing for the needs of exploration activities in the NWT, notably in the Fort Smith region and along the Mackenzie River.

Charter air are used to augment existing passenger and cargo service in most communities

2.3 Cargo Services

Most northern communities rely heavily on air cargo service for the shipment of basic goods and produce because of the lack of infrastructure for other modes of transportation. Freight capacity is mostly provided through scheduled service between southern points and the northern hubs on the B727, B737 and the HS748 combis operated by most of the mainline air carriers (Calm Air, Canadian North, First Air and NWT Air). Freight is usually redistributed in a timely manner to remote communities on regional and local scheduled and charter flights.

A directional imbalance in favour of inbound cargo exists within the system because of the economic and geographic characteristics of the north. Substantial amounts of perishable goods are transported to the communities of the NWT, notably through the Food Mail Program operated by the Department of Indian and Northern Affairs and Northern Development (DIAND). Shipment of replacement parts in support of mineral and exploration activities also account for part of the volumes of cargo shipped to the north.

In light of existing directional imbalances, the operation of combi aircraft provides maximum flexibility for northern operations. In some cases northbound flights will overnight in the North and then return the next day with a greater number of seats. This flexibility is also important when catering to increases in demand that might be experienced through annual growth. For example, if the passenger demand on a specific Friday in August is 40 passengers but in the following year it increases to 48, two additional seat rows can be added without changing the level of flight frequency.

Because the size of loads (either passenger or cargo) in the NWT is extremely variable, combi operations also increase the flexibility of operations. These aircraft can be quickly adjusted in terms of seat capacity or pallet positions, depending on the load on any given day. For instance, First Air's B727-200 C has a maximum seat configuration of 172 seats with no upper deck pallets. With the standard combi configuration, space for five upper deck pallets and seating for 84 passengers is provided. The aircraft can be ultimately configured to provide space for nine pallet positions and only 19 seats. The HS748 is also frequently used in combi configuration. The First Air HS748 has a maximum seat capacity of 48 seats and 24 seats in combi configuration. On average, however, the aircraft is configured for 16-20 seats with the rest of the space used for cargo. Cargo space can be allocated in increments of four seats. Note that passengers generally have first priority over cargo. If there is an expected heavy volume of passengers for a particular flight, additional rows of seats will be put on the aircraft, reducing the number of pallet positions.

In addition to the scheduled services, charter and specialized cargo operations are common. Mine site and exploration support, in particular, generate substantial cargo activity. Other specific and specialized freight services involve fuel and other bulk cargo supply to communities, sometimes using ice runways.

2.4 Medevac Services

For many communities, air transportation is the sole avenue of access to specialized medical services and hospital care. Consequently, the availability of reliable and responsive medevac services is accorded a high priority by the Government of the Northwest Territories, the Regional Health Boards, and Community administrations. The specialized nature of medevac operations, imposes demands on the contractor air carriers providing the service, in addition to those always attendant in the Northern aviation environment.

The overall program is centrally administered by the GNWT and regionally implemented by Hospital/Health Boards. The GNWT establishes the standards for air carriers providing medevac services and each individual board negotiates standing offer agreements with carriers meeting the required standards. The initiation and management of a specific call out against the standing offer is carried out by individual Hospital/ Health Boards.

Air carrier operating standards are established by the Department of Health and Social Services. The standards specify qualification and experience requirements for the crew, and identify aircraft equipment and environmental requirements for the medevac role. Apart from a statement of preference for pressurized aircraft, however, other aircraft operational and performance characteristics are not addressed.

Given the wide spectrum of aircraft types operating in the North, it is not surprising that the medevac fleet also consists of numerous aircraft types. Ranging from LearJets to Piper Navajos, the mix represents a broad range of performance capabilities. As may be expected, the desire for rapid response creates a preference for air carriers closest to the pick up airport and/or offering the fastest aircraft.

The desire for rapid response creates a preference for air carriers closest to the pick up airport and/or offering the fastest aircraft.

The Community Survey conducted for this study resulted in two communities rating medevac services as poor, and one specifically requesting runway extension for improved medevac service. Since no other specific comments were received from the 52 other communities responding to the survey, the general level of satisfaction with medevac services appears to be quite high. It is important to note that two communities (Grise Fiord and Snare Lake) complaining of service have airports without published instrument approaches. Grise Fiord is also located in an area of high terrain.

2.5 Summary

The Northwest Territories are served by an extensive air transportation network that links the region from east to west and to points in the South. This system is characterized by:

- 46 airports owned and operated by the Government of the Northwest Territories receiving scheduled service.
- Scheduled gateway jet air services that link the three northern gateway airports to Southern hubs.
- Scheduled trunk services that link the airports in each regional administrative centre.
- Scheduled feeder air services that link small communities to their regional administrative centres.
- Charter air services that augment scheduled services.
- Cargo air services, either by dedicated freighters or by combi passenger/cargo services.
- Medevac services provided in a variety of aircraft types. Standards for medevac services are established by the Department of Health and Social Services.

Endnotes

1. Based on a consolidation of the Winter 1997/98 flight schedules of the scheduled air carriers operating in the NWT.

3. Community and Air Carrier Surveys

The supply of air services in the NWT is dependent not only on traffic demand but also on a number of other factors, specifically the availability and quality of airport infrastructure. Because of the relationship that exists between air services and airport infrastructure, identification of site deficiencies constitutes an essential input to system analysis. For the purpose of this study, stakeholders were consulted to assess levels of satisfaction with existing airport facilities. Surveys were conducted with two stakeholder groups – community leaders and northern air carriers. In both cases, questionnaires were sent to stakeholders and where required, follow-up information was obtained through telephone interviews. This section reviews the survey findings. Note that the site deficiencies identified in this section are based on stakeholder observations and comments and do not necessarily reflect actual site requirements. Specific runway requirements will be addressed in the analysis undertaken in Section 7.

3.1 Community Survey Results

Community surveys were conducted to identify the air service needs of local users of the 52 GNWT airports, and their satisfaction with existing service levels. In total, 60 community leaders were contacted. Appendix 2 profiles the socio-economic and transportation characteristics of each community. The strong community interest in the topic was evident in the very high response rate of 92% (55 responses). A sample of the questionnaire and a survey contact report are respectively provided in Appendices 3 and 4.

52 Airports surveyed

92% response rate

Approximately 75% had no concerns regarding runway facilities

Existing airport facilities (runway and other airport facilities) are considered inadequate to meet local needs by 76% of the respondents. The deficiencies identified by the remaining group of respondents are grouped into three general categories, those specifically relating to runway facilities, other airport facilities and existing air service levels. The following subsections provide an overview of the deficiencies identified. Appendix 5 contains a more detailed view of survey results.

3.1.1 Runway Facilities

Of the communities that responded, a high proportion, approximately 75% of total respondents, did not identify concerns relating to runway facilities. Insufficient runway lengths are the most common deficiencies cited since longer runways are often equated with the introduction of jet service. Table 3.1 provides a summary of the deficiencies identified.

Table 3.1
Runway Deficiencies Identified
by Community Leaders

COMMUNITY	REGION	DEFICIENCIES
Arviat	Keewatin	• Runway extension required.
Cambridge Bay	Kitikmeot	• Runway needs paving to improve air carrier service levels (accommodate more aircraft types, provide operational flexibility to air carriers), and to meet air travel demands.
Chesterfield Inlet	Keewatin	• Airstrip too short – does not allow larger aircraft to land or depart with a full load.
Clyde River	Baffin	• Cross wind problems • Safety concerns – to access terminal building, must drive across strip
Colville Lake	Inuvik	• Requires longer runway to accommodate regular scheduled service and larger aircraft.
Déline	Inuvik	• Erosion of airstrip identified. • Backup runway lighting required during power outages.
Igloolik	Baffin	• Runway extension required to accommodate jet service.
Kugluktuk	Kitikmeot	• Airstrip paving required to accommodate jet service resulting from increased demand (from creation of Nunavut).
Nahanni Butte	Fort Smith	• Crosswind problems require new or relocated runway.
Rae Lakes	Fort Smith	• Expansion of airstrip to accommodate increased traffic.
Rankin Inlet	Keewatin	• Improve runway approach/landing system in bad weather.
Repulse Bay	Keewatin	• Runway too short – relocation of airstrip required to accommodate larger aircraft.
Taloyoak	Kitikmeot	• Runway extension required to provide better service and accommodate aircraft needed for medevacs and freight.
Trout Lake	Fort Smith	• Runway relocation required to solve crosswind problems.
Whale Cove	Keewatin	• Runway resurfacing required – subsurface currently exposed. • Access road required around runway.

3.1.2 Other Airport Facilities

Many communities leader also expressed concerns regarding airport facilities other than runways. The most common issues raised in this area relate to inadequacies in terminal facilities. Of all communities that responded, approximately 42% stated that current facilities did not meet the needs of the community. Table 3.2 provides a summary of the deficiencies identified and issues raised.

Table 3.2
Other Airport Facility Deficiencies and Issues Identified
by Community Leaders

COMMUNITY	REGION	DEFICIENCIES AND ISSUES
Broughton Island	Baffin	• Inadequate Air Terminal Building – too small, too old, does not meet code, no services for handicapped, electrical problems.
Cape Dorset	Baffin	• Lacks fire equipment. • Ageing equipment. (i.e., snowblower more than 20 years old) • Lack of personnel training. • Full time weatherman required on site.
Chesterfield Inlet	Keewatin	• Terminal too small.
Clyde River	Baffin	• Inadequate terminal building—in poor condition, too small
Colville Lake	Inuvik	• Lacks fire equipment.
Coral Harbour	Keewatin	• Terminal too small to meet traffic needs. • Poor airport lighting.
Déline	Inuvik	• Community Airport Radio Station considered essential to ensure safety.
Fort Good Hope	Inuvik	• Instrument flight advisories required during extreme weather conditions.
Gjoa Haven	Kitikmeot	• Airport lighting needed. • Heavy equipment required for runway maintenance. • Improve terminal facilities needed.
Grise Fiord	Baffin	• Community Airport Radio Station located in area were weather conditions may differ from those at runway.(Note; CARS is programmed for re-location to airport site)
Hay River	Fort Smith	• Fuelling facility needed. • Instrument Landing System should be maintained.
Holman	Kitikmeot	• Terminal too small and outdated (new passenger terminal building scheduled for 1998).
Iqaluit	Baffin	• Emergency Rescue Service (ERS) sorely missed.
Kugluktuk	Kitikmeot	• Repairs needed in Terminal building (scheduled for 1998/99) • Department of Transportation land reserves impede logical development of hamlet.
Rae Lakes	Fort Smith	• Inadequate passenger shelter facility – need to replace trailer with new shelter. • Fencing required around airstrip to ensure safety. • Community Airport Radio Station required to ensure safety.
Repulse Bay	Keewatin	• Airport too small.
Resolute	Baffin	• Possible reduction of Flight Service Station (FSS) to Community Airport Radio Station status. • Removal of Emergency Rescue Service.
Snare Lakes	Fort Smith	• Airport maintenance staff training needs not met on timely basis. • Poor response when ordering repair parts. (for a/p lighting,

COMMUNITY	REGION	DEFICIENCIES AND ISSUES
		etc.) when required
Taloyoak	Kitikmeot	• Terminal too small to meet needs of population and traffic.
Tuktoyaktuk	Inuvik	• Poor airport lighting.
Trout Lake	Fort Smith	• Needs airport shelter.
What'Ti	Fort Smith	• Terminal building needed.
Yellowknife	Fort Smith	• Would like advisory committee to oversee airport operations.

3.1.3 Air Services Levels

The quality of local air services is considered of importance to many community leaders. Of all respondents, almost 40% expressed concerns over at least one aspect of air services. The most commonly cited problem relates to the high cost of air travel, followed by the desire to see more destinations served and increased scheduled services from the different communities. Monopolistic markets, where certain communities or specific routes were served by a sole carrier, are believed by some to contribute to the current cost of air travel and poor levels of service. As such, increased competition is greatly supported. Table 3.3 summarizes the issues raised by the community leaders contacted.

Most common concern with air services:

High cost of air travel

Table 3.3 - Level of Service Issues Identified by Community Surveys

COMMUNITY	REGION	ISSUES
Broughton Island	Baffin	Unreliable services – flights often cancelled under poor weather conditions. More frequent & regular scheduled flights needed.
Chesterfield Inlet	Keewatin	• More scheduled services needed. • Need to accommodate cargo.
Clyde River	Baffin	• Airfares and cargo rates too high – need service by more than one carrier
Coral Harbour	Keewatin	• Airfares too high. • Poor passenger and cargo services.
Gjoa Haven	Kitikmeot	• Scheduled services needed to Iqaluit and eastern points (due to creation of Nunavut). • Faster aircraft and more capacity needed.
Grise Fiord	Baffin	• Poor medevac services. • Increased flight frequencies and service by other carriers needed.
Hall Beach	Baffin	• Airfares too high.
Hay River	Fort Smith	• North/south fares too high compared to east/west.
Holman	Kitikmeot	• Airfares too high. • Regular service needed from Inuvik (as part of future Western Territory).
Igloolik	Baffin	• More competition, increased frequencies and service to more destinations needed to accommodate anticipated growth (resulting from creation of Nunavut). • Jet service needed to lower commodity costs.
Iqaluit	Baffin	• Fares too high.
Kugluktuk	Kitikmeot	• More direct East-West services required (due to creation of Nunavut). • Increased traffic volumes create need for jet service.
Nahanni Butte	Fort Smith	• Airfares too high.
Pangnirtung	Baffin	• Scheduled cargo services required.
Pelly Bay	Kitikmeot	• Improved passenger and cargo services required - better and faster connections to hub airports, increased frequencies, and more direct service.
Rankin Inlet	Keewatin	• Maintenance of current air service levels – major mining activity requires large aircraft
Repulse Bay	Keewatin	• Poor on-time performance from carriers. • Increased frequencies needed to serve population growth.
Resolute	Baffin	• Airfares too high – lower fares needed to stimulate tourism.
Sanikiluaq	Baffin	• Airfares too high • Service to more destinations and scheduled services needed to Keewatin region.
Snare Lakes	Fort Smith	• Poor medevac services.
What'Ti	Fort Smith	• Larger aircraft needed to meet demand for air services. • Poor service from carrier personnel (e.g. missed bookings).
Wrigley	Fort Smith	• Schedules services needed.

3.2 Air Carrier Survey Results

The air carrier survey was conducted to identify the impact that existing airport facilities have on the provision of air services in the North. The survey focused on identifying the factors that are expected to influence carrier operations over the next twenty years. These factors include anticipated changes in local demand, and the operational limits of existing facilities. Information relating to existing routes, frequencies and aircraft operated was also sought. This information was used to complement the discussion on the existing air service structure presented in Section 2, and to provide insight on the development of the future air service system.

Input was solicited from 24 air carriers currently providing scheduled, charter and medevac services in the region, most members of the Northern Air Transportation Association (NATA). Respondents consisted mainly of company directors, operations managers or chief pilots. A sample of the questionnaire is provided in Appendix 6. Upon completion of survey activities, a response rate of 80% percent was attained (20 responses). The issues identified by the air carriers can be grouped into three categories, those related to anticipated changes to traffic supply/demand, runway limits or constraints, and other operational constraints. The following subsections summarize the responses provided.

3.2.1 Anticipated Changes

In spite of the assumptions that the creation of the Nunavut Territory is expected to change air traffic patterns in the North, 30% of all respondents expect no changes to occur to supply/demand over the next twenty years and 10% are unable to predict changes based on current operating conditions. However, 20% of air carrier respondents foresee increases in demand and concurrently, in provision of scheduled services.

Air Carrier Survey

30% expect no air service changes due to formation of Nunavut

75% of carriers not limited by existing runways

Also of concern: deficiencies in navigational aids, communications, weather reporting

3.2.2 Runway Constraints

Runway dimensions and surfaces are linked to service levels because they may limit the types of aircraft that can serve a specific airport. Because the calculation of take off and landing distance is associated with many variables, the air carriers were asked if GNWT runways restricted their current operations. The survey results, however, reflected that a high proportion, 75% of the air carriers to have responded, are not limited by existing runways – this group included most air carriers providing scheduled services. More specifically, only 13% of respondents reported facing operational limitations due to current runway lengths or other runway deficiencies related to runway surfacing.

Of the 52 GNWT-operated airports, only 7 were specifically identified as requiring runway extensions (see table 3.5). It should be noted that the survey asked air carriers if existing runways imposed a constraint to their current operations. In Sections 5 and 6 of this report, future requirements are assessed.

Slightly more than 20% of respondents identified runway surfaces to be inadequate at four northern airports. The unpaved runway surface at Cambridge Bay is the most noteworthy.

3.2.3 Other Operational Constraints

A number of other operational factors are also considered to impede carrier operations at GNWT airports. The most important are deficiencies relating to existing navigational aids, communications and weather reporting systems. Of all respondents, half have identified that the limited availability or lack of such services is a problem common to many northern airports. Note that this is the highest frequency observed of all survey responses relating to a single facility constraint. Several carriers addressed the question of Automatic Weather Observing Systems (AWOS). Most carriers recognized the potential of these devices for contributing additional data at sites without or only limited reporting, but this should not be at the expense of human observations.

Of the other deficiencies cited, inadequate or lack of fuel facilities were also identified. Table 3.4 provides the frequency of carrier responses that relate to other airport facility deficiencies.

Table 3.4
Other Operational Constraints Identified
by Air Carrier Operators

Response	*Response Frequency*
Inadequate Navaids/Communications	10
Inadequate Fuel Facilities	4
Other	3
No Deficiencies Noted	4
Total Respondents	*20*

3.3 Summary

The results of the two surveys showed considerable convergence around the question of the adequacy of current runway lengths. The same percentage of respondent in both surveys - 75% - expressed the opinion that runway facilities were adequate. Together, the respondents of the two surveys identified eleven airports where runway lengths were perceived to be inadequate.

Table 3.5
Community and Air Carrier Survey Results
Airport Runways Extension Responses

SITE	*Community Comment*	*Air Carrier Comment*
Arviat	X	
Chesterfield Inlet	X	X
Colville Lake	X	
Igloolik	X	
Jean Marie River	X	X
Kimmirut	X	X
Nahanni Butte	X	X
Rae Lakes	X	
Repulse Bay	X	X
Taloyoak	X	X
Trout Lake		X

In addition, it should be noted that some carriers and communities made general comments that referred to runway requirements. In the ensuing analysis in this report, the adequacy of runways at all GNWT airports will be assessed.

The air carrier survey also produced a significant response with respect to the need for improved communications, weather reporting and navigation aids.

4. Factors in Air Service Development

4.1 Air Service Factors

This section describes the main factors that, directly or indirectly, impact upon the supply/demand patterns of air services in the NWT, and identifies the changes or new developments that will characterize the future Northern air service structure. The major shaping factors include the economics of the region, new territorial governance structures, aviation-related technologies (particularly aircraft), and the new regulatory environment under the Canadian Aviation Regulations (CARs).

4.2 Economics

4.2.1 The NWT Economy

One of the most important factors determining the demand for air services is that of economic conditions. Many studies of air travel find, in general, that consumer/business demand for air service grows at 1.5 to 2.0 times the growth in the economy. This means that if economic activity in a given region grows by 10% over a certain time period, air travel would normally grow between 15% - 20% during the same period.

However, the economy of the NWT is unique. It is based on a very small and widely dispersed population. Economic activity is concentrated in a few specialized industries. The NWT does not have the diversified type of economy found elsewhere. Because of the small population and industrial base of the NWT, forecasting is subject to even larger errors than forecasting elsewhere. Simply applying statistics from urbanized areas will not produce meaningful forecasts.

Presently, the NWT economy is undergoing a fundamental transformation. While government spending and investment had accounted for over 70% of total Gross Domestic Product (GDP) as late as 1993, today that proportion is approaching 50%. Few economies in the world are subjected to such a large shift in their economic base in such a short period.

While government spending and investment had accounted for over 70% of total Gross Domestic Product (GDP) as late as 1993, today that proportion is approaching 50%.

Few economies in the world are subjected to such a large shift in their economic base in such a short period.

The largest non-government sector in the economy is mining and resource extraction. As stated in the GNWT *Economic Review and Outlook*, "...mining and petroleum development appear certain to become the prime source of economic wealth for the NWT in years to come. "

The challenge to the NWT is to cope with the extreme volatility of these industries. Non-renewable resources are commodities which trade in world markets at world prices. These industries have conditions (economists refer to them as supply and demand elasticities) whereby small changes in supply or demand can result in significant price swings. For example the ability of OPEC to more than triple the price of crude oil in a single year was based on simply removing a few percentage points of world supply. These dramatic swings in resource prices result in what can be catastrophic changes in local resource employment. A decline in the price of nickel may result in mine closures as world supply adjusts to the excess demand conditions which drove prices down. The swings in the resource economy in turn lead to dramatic swings in demand for air travel.

The NWT economy is further complicated by the fact that the resource industries only procure a small portion of their goods and services (17%) from the territorial economy.

The result is that predicting future economic conditions in the NWT is extremely difficult. Rather than develop a sophisticated economic forecast, we prefer instead to list below what we believe to be the main characteristics of the future NWT economy.

- The economy of the NWT is expected to continue to grow over the next 20 years.
- In general, it is expected that the economy of the NWT will grow somewhat slower than the economy of Canada overall. This is due in part to the fact that while there will be strong output (especially of resources), many of the expenditures for labour and supplies accrue outside of the NWT.
- Specifically, during the period to 2006, GDP for the NWT is expected to grow at 1.2% per annum. This compares with an expectation of roughly double that amount for Canada overall.
- Growth will be strongest in those regions with mineral development. These are concentrated in the Western Territories, although there are some developments in Nunavut.

The economy of the NWT is expected to grow at 1.2% per annum to the year 2006

This is roughly half the expected growth rate for Canada overall

Population is expected to grow 2.1% per annum

- Some communities will experience growth rates significantly in excess of the average. Resource communities in particular, may achieve very high growth rates of economic activity. However these same communities will have high risk in sustaining economic growth, as they can be affected by relatively small changes in resource market conditions.
- Some communities will face dramatic declines in economic activity as resources are fully depleted or become uneconomic due to developments in world prices.

- The petroleum sector offers significant long-term potential for development, although there are significant social and infrastructure issues which would need to be addressed.
- Population growth rates (roughly 2.1% per annum) exceed the projected rate of economic growth.

4.2.2 Economics of Northern Air Services

4.2.2.1 Level of Air Service and Annual Passenger Volumes

Table 4.1 relates the capacity of an aircraft to the annual volume of passengers required to support that capacity. It is intended as a guide to the levels of service a community is roughly able to support. In constructing the table, it was assumed that the air carrier providing the service would require an average load factor (per cent of seats filled with revenue customers) of 65%.

Table 4.1
Annual Passengers Required for Various Service Levels

Aircraft Type	Departure Frequency	Seat Capacity	Annual Seats Required	Service
B737-combi	daily	60	14,235	Non-stop
B737-combi	daily	60	7,118	1-stop first city
B737-combi	daily	60	10,768 plus 1,000 local passengers	1-stop second city
B737-combi	3x weekly	60*	5,618	Non-stop
Dash 8	daily	36	8,541	Non-stop
Dash 8	3x weekly	18	1,684	Non-stop

**assumes that another stop on the route uses half of the aircraft's capacity*

The table indicates, for example, that 14,235 passengers per year are required to support daily non-stop service on a B737-combi which has 60 seats (with the balance of the aircraft dedicated to cargo). (This is computed as 60*365*65%.) Daily Dash-8 service requires 8,541 passengers per year.

If the route has multiple stops, then the capacity of the aircraft might be shared between two points, as indicated in the second row of the table. However, the sharing of capacity must recognize that a carrier cannot afford to fly the second leg of the flight with only half a load. Either some additional local traffic is required, or a greater percentage of the aircraft capacity must be filled by long haul traffic. This is shown in the third row by assuming the carrier needs 1,000 local (1st stop to 2nd stop) traffic, plus an additional 10 passengers per flight of through-traffic (from flight origin to the 2nd stop).

The fourth row indicates the effect of reducing the service level below daily. The next two rows give examples of changing aircraft type. Small aircraft types make daily service possible to moderately sized markets, and makes some scheduled service possible at low traffic points.

4.2.2.2 *Importance of Cargo*

Air cargo is of critical importance in supporting air services to northern communities. Not only does it provide a critical transportation service for daily necessities, it also supports passenger air services. In table 4.1, daily B737-combi service can be supported in a market which generates 14,235 passengers per year. If the aircraft operated were a passenger-only aircraft, then the required passenger volume increases to 25,623. Equivalently, the carriage of passengers supports scheduled cargo services.

> Not only does cargo provide a critical transportation service for daily necessities, it also supports passenger air services

This point is of some importance in the future pattern of passenger services in the north. The current aircraft used to service the gateway and regional hubs is the B737-200 combi aircraft. During the next 10-20 years, this aircraft will need to be replaced. The B737-200 has been an ideal aircraft for the North, as it is gravel capable, can operate on short runways, and is strong enough to be fitted as a combi. One possible service pattern which could be adopted in the future is separate dedicated passenger and dedicated cargo services, rather than the combi services used at present. Without the cargo loads in the combi aircraft, the future air service network may result in lower service, for both passenger and cargo services.

4.2.2.3 *The Link Between Load Factors and Airfares*

It is also important to emphasize the importance of load factors in carrier economics. Most costs associated with flying an aircraft between two points do not vary with the number of passengers. Economists call these “fixed” costs. These fixed costs must be covered by the number of passengers on the flight. If the flight operates with a high load factor, then there are more passengers who can help cover the fixed costs. The result is lower airfares. On the other hand, if the flight operates with relatively fewer passengers, then the average airfare will have to be higher, as there are fewer passengers to share in the burden of the fixed costs. Simply put, flights which can operate with high load factors will result in lower airfares.

A route which is operated with a larger aircraft, or with a jet rather than a turboprop, has higher fixed costs. If the capacity of the jet cannot be filled with a reasonably high load factor, then the result will inevitably be higher airfares. The economics of the routes are such that low airfares can only be supported by a) aircraft whose capacity are properly matched to the routes they operate, b) high load factors, c) multi-stops, if required to achieve high load factors, and d) cargo loads which contribute to the fixed costs of the flight. If any of these four factors are deficient, then the route will necessarily have high fares.

4.3 Territorial Governance

The Government of the Northwest Territories currently has jurisdiction over most of the Canadian Arctic region with the exception of the Yukon and Northern Quebec. Because the Territory's relatively small population is dispersed over large distances, the provision of governmental services is structured around five administrative regions,[ii] each with its own administrative centre. This administrative structure has influenced the travel demand/patterns that exist within the territory because of the concentration of governmental employees in each administrative centre. Governmental wages and work-related travel have contributed to the demand for air services in these centres, each of which also possesses a hub airport status.

New Territorial Governance will likely:

Decrease East-West travel to Yellowknife

Increase travel to regional administrative centres

Increase total travel

As of April 1, 1999 however, the political structure of the NWT will undergo considerable change with the creation of the Nunavut Territory. In the Western Territory, governmental services are expected to be reorganized to take into account the new political structure of the region. While Yellowknife will remain the capital of the Western Territory, activities are expected to be downsized, notably with the transfer of 250 positions to the Nunavut Government. As a result, travel between Yellowknife and Nunavut communities may decrease over the long-term period. In the short-term, however, there should be a substantial increase in air travel demand between the two Territories as relocation takes place.

As for the Nunavut Territory, the governance structure will see the central seat of government in Iqaluit, three regional offices in Cambridge Bay, Igloolik and Rankin Inlet, and seven regional auxiliary offices, supporting the three regional offices. Figure 4.1 illustrates the new political boundaries that come into effect in 1999 and depicts the location of each regional centre.

The proposed administrative structure is expected to increase government employment in Nunavut by more than 650 people, increasing current employment levels by approximately 150%. Table 4.2 provides details of the proposed distribution of government staff in the Nunavut Territory. The impact of decentralized government in Nunavut on air travel will be increased traffic between the regional and auxiliary offices. This should be especially notable in Igloolik, which should see demand for new air service routes once auxiliary offices are put on place.

Additional impacts of the future northern political structure on regional traffic may result from the projects implemented by the new Government. For example, one of the key recommendations of the Nunavut Implementation Commission calls for a major improvement in communications infrastructure. It is unclear where the funding for this project will come from. If some of the funding comes out of the annual travel budget, air travel demand and the level of air services may be adversely affected. If it does not, a positive impact may result with travel being stimulated by community interest to supplement communications with face-to-face visitations.

Figure 4.1
NWT and Nunavut Administrative Centres

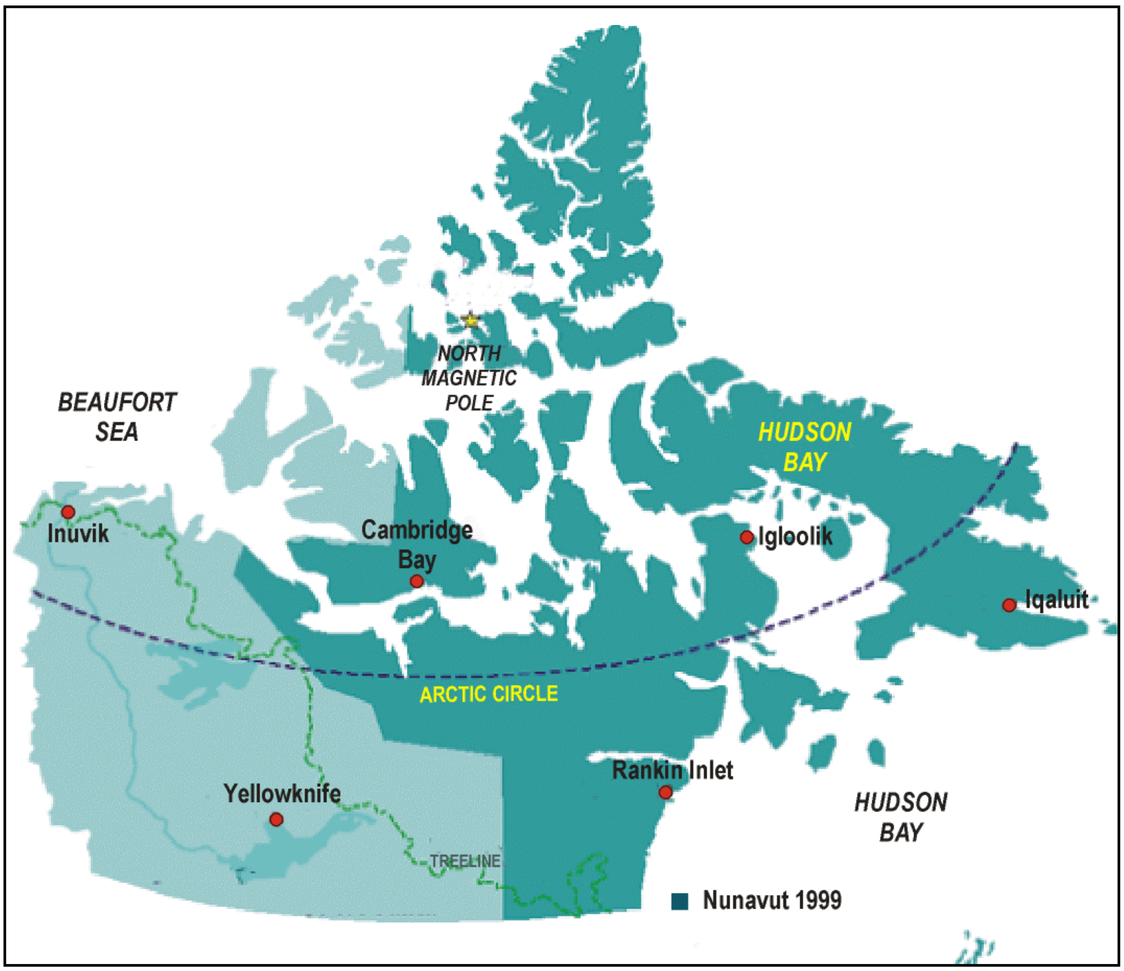


Table 4.2
Distribution of Additional Government Staff
In the New Nunavut Regional Government

Central Government	Office Designation	Current Staff Level	New Staff Level	Absolute Increase	Percentage Increase
Iqaluit	Central	210	374	164	78%
Cambridge Bay	Regional	81	110	29	36%
Gjoa Haven	Auxiliary	0	22	22	INF
Kugluktuk	Auxiliary	20	36	56	180%
Igloolik	Regional	0	75	75	INF
Cape Dorset	Auxiliary	0	57	57	INF
Pangnirtung	Auxiliary	0	69	69	INF
Pond Inlet	Auxiliary	2	70	72	INF
Rankin Inlet	Regional	101	135	34	34%
Arviat	Auxiliary	18	53	71	294%
Baker Lake	Auxiliary	14	45	59	321%
Total Staff Level		446	1,100	654[2]	147%

INF = Infinity since base is zero.
Source: Footprints 2, Appendix F, October 1996.
2. A press release dated January 14, 1998, has stated that total staff may reach 675 with most new additions expected to be in Iqaluit.

4.4 Technology

Advances in aviation-related technology directly and indirectly affect aircraft runway requirements. Changing aircraft performance has a fundamental influence on runway characteristics while other factors such as instrument approach requirements and runway conditions have a less evident, but nevertheless profound, impact. In sum, future operating environments will fashion operational needs and runway lengths. In considering these advances, although it is difficult to forecast their exact timing, understanding and anticipating the trends with respect to northern operations is essential to understanding the future system requirements and their impacts on the future air service system.

This section will review the factors that will influence the future runway requirements of air carriers operating in the NWT. These factors relate to trends in aircraft development, air navigation and communications, as well as runway construction and maintenance technologies.

4.4.1 Trends in Aircraft Development

With many of the Northern aircraft fleet now well in excess of 25 years of service, replacement by newer aircraft is under consideration by many operators. The high initial cost of new equipment ensures that most replacement aircraft will come from the used market. The increasing demand for regional jets in Southern markets is now starting to generate a supply of relatively modern turboprops at competitive prices.

Included in the aircraft to be replaced by regional jets are the DHC-8/100/200 series, the ATR 42, Dornier 228, and SAAB 340B. These aircraft are capable of operating on gravel runway and are convertible to "combi" configuration. Fuel efficient and relatively fast, this generation of turboprops also tends to have very good runway performance. The DHC 8-200 for example, requires only 3,500 feet of runway for take-off at maximum weight (Sea level, 15°C). Such aircraft will not only bring greater comfort to Northern air travel, but improved economics as well, offsetting their higher acquisition cost.

Complementing the large turboprops are the 19 seat aircraft such as the Embraer-110 Bandeirante and the combi Beech 1900D. The latter, together with the Kingair 350/200 series, are suitable replacements for the many B-99s in service.

A new and emerging category well-suited to the northern operational environment is the new family of single-engine turboprops. Benefiting from the recent approvals for IFR/night carriage of passengers, aircraft such as the Cessna Caravan and Pilatus PC-12 are capable of filling a wide spectrum of roles. The PC-12 can cruise at altitudes up to 30,000 feet at 265 kt and has won acceptance in corporate and medevac roles. The Caravan now operates in 52 countries with over half of the fleet engaged in scheduled passenger and freight operations.

By the latter part of the period covered by this study (2007-2017), replacement of the B727-100/200 and B737-200 combi jet turbine aircraft will be required. Replacement aircraft will have to be selected from turbo fan powered airliners such as the B737-300 and later models. However, since low slung fan engines are very susceptible to Foreign Object Debris (FOD) damage, operation from gravel runways will probably not be certified for some models.

<u>Replacement Aircraft</u>

Many aircraft in the fleet have been in service for 25 or more years

Boeing 737-200 and 727's will be replaced during the next 20 years

Replacement aircraft will have improved performance and require less runway than contemporary aircraft. aircraft types

Furthermore, increasing numbers of used regional jets will become available during the same period, many of which will prove attractive for many Northern markets. These aircraft range in size from the new 30-seat DornierJET to the 85-seat Bae RJ85, and will require runway lengths varying from 3,000 to 6,000 feet.

In summary, the dominant factor associated with the introduction of new aircraft technology will be improved performance and a concomitant reduction in runway length operating requirements. However, as regional jets enter the structure later in the period, runway requirements may increase on some routes. Appendix 7 contains performance data for typical replacement aircraft.

Observation: The improved performance associated with replacement turboprop aircraft such as the DHC-8-200 and the ATR 42-300 will reduce runway length requirements compared to contemporary aircraft

4.4.2 Air Navigation and Communications

The most significant recent development to overall Northern operations has undoubtedly been the introduction of satellite based navigation systems, such as Global Positioning Systems (GPS). Already introduced for instrument approach procedures at some Arctic airports, GPS technologies increase reliability and accuracy in bad weather operations as they allow for lower approach limits and optimize final approach tracks. More widespread use of GPS will result, therefore, in greater airport usability under instrument conditions.

Some air carriers have already benefited from these technologies. New regulations, for example, now require commuter and transport category aircraft to achieve an obstacle free path after take-off in the event of an engine failure. One way to achieve this with lower performance aircraft is to navigate around obstacles. GPS have provided the means to do this.

Similarly, in an area of sparse navigation aid coverage, GPS provides continuous information that permits flight profile optimization, enhanced efficiency and lower operating costs.

4.4.3 Runway Construction and Maintenance Technologies

Research has been ongoing for some time into the development of an effective dust suppressant/surface binder to apply to gravel runways. The availability of such a product would not only reduce the risk of Foreign Object Debris damage to engines and airframes, but would also improve take-off and landing performance.

Although not yet a reality, it is expected that a suitable process will be developed during the planning period.

4.5 Regulatory Environment – Canadian Aviation Regulations(CARs)

The revised Canadian Aviation Regulations issued in 1996 have brought into being a new regulatory regime that has had particular impact on operators of air taxi and commuter services. Intended to enhance the safety of small and medium sized aircraft operations, the regulations impose requirements that will significantly influence operations at some airports. This section contains a summary of the regulations that impact upon runway requirements.

<u>Revised Aeronautical Regulations</u>

1996 Revisions to CAR's may impose requirements that affect operations at some airports.

All airports supporting scheduled passenger services must be certified

An aeronautical study needs to be done for each airport which is not currently certified.

4.5.1 Take-Off Performance Requirements

Take-off performance requirements apply to aircraft with more than nine passenger seats and all turbo-jet aircraft. These aircraft must demonstrate that sufficient runway is provided for the Accelerate-Stop Distance required under the conditions existing at the time of take-off. Furthermore, multi-engine aircraft over 5,670 kg gross weight must demonstrate that sufficient runway length is available for take-off in the event of an engine failure or that sufficient remaining runway is sufficient to allow the aircraft to stop.

Provisional relief has been provided from the Accelerate-Stop Distance requirement for operators of propeller driven aircraft under 5,670 kg MCTOW until December 20, 2010. This category includes the Twin Otter. Reconfiguration of the aircraft to prevent more than nine seats being occupied is also an alternative option.

Given that Accelerate-Stop Distance is greater than all engines operating take-off distance, the introduction of this requirement for aircraft with 10 seats impacts some operations. In addition, large propeller driven aircraft (MCTOW greater than 5,670 kg) are required to have sufficient runway to meet Take-Off Distance Available requirements in the event of an engine failure. The aircraft types most acutely affected by these requirements are older piston-engined aircraft such as the DC-3 and C-46. Also, some older twin turboprops may not have certified performance data for these parameters which could impact their use after 2010.

4.5.2 Net Take-off Flight Path Requirements

The purpose of the net flight path requirement is to ensure that in the event of an engine failure the aircraft will avoid all obstacles by 35 feet vertically and at least 200 feet horizontally within the airfield boundary and 300 feet horizontally outside the airfield boundary. This criterion is being met with most existing aircraft types. In general, the more modern aircraft possess equal to or better take-off performance and so it is not anticipated that there would be a decrement in payload as a result of operations with replacement aircraft.

4.5.3 Contaminated Runway Operation Requirements

CAR 705.55 requires that all turbojet aircraft operating on surfaces that are other than bare and dry take into account any decrement on performance (acceleration or deceleration as the case may be) that may be required. A revision to the associated standard to this regulation (725.54, see Appendix 8) has been released and is scheduled for discussion at the March 1998 Canadian Aviation Regulation Advisory Council (CARAC) meeting. If adopted, the standard will result in potentially severe weight penalties on older types of turbojet aeroplanes operating from contaminated runways of 6,000 ft. or less. This regulation, combined with the fact that runways in the Canadian Arctic are subject to “contamination” for approximately half of the year could have considerable implications for operators of turbojet aircraft. Although the proposed regulations deal with only turbojet aircraft, it should be noted that similar regulations, which currently exist in European countries, are applicable to turboprop aircraft as well. In light of the current push for “harmonization” among the regulatory bodies, the potential for impact on other types of aircraft cannot be overlooked.

4.5.4 Cargo Compartment Standards

The standards applicable to cargo compartments are a consideration in the adaptability and cost of future replacement aircraft to be utilized in combined main deck passenger and cargo (combi) role. Cargo compartments greater than 300 cubic feet in volume will be required to meet “C” type compartment fire criteria. This criteria is considerably more demanding than the earlier “B” compartment criteria and much more expensive to certify. The result could be fewer certified "combi" types being available.

4.5.5 Single-Engine IFR Passenger Operation Requirements

Provided that they meet criteria, single-engine turbine powered aircraft may carry passengers at night or in instrument conditions (IFR). Aircraft types that currently meet the criteria include:

- Cessna Caravan
- Pilatus PC-12
- SocataTBM 700

No more than nine passengers may be carried on single-engine aircraft.

4.5.6 Aerodrome Certification Requirements

Aerodromes used to provide scheduled passenger services are now required to be certified as airports. To obtain certification the airport must comply with standards and recommended practices defined in Transport Canada publications. Where compliance is not achieved, certification may be approved if an aeronautical study determines that an equivalent level of safety could be achieved by alternate means.

This regulation clearly has implication for the ten uncertified GNWT airports, eight of which are currently served by scheduled service. (Further discussed in Section 7).

4.5.7 Summary of Potential CARs Impacts

It is not expected that the new take-off performance regulations will have any immediate effect on runway requirements. Indeed, by imposing constraints on older aircraft types, the CARs may hasten the conversion to newer aircraft having reduced runway length needs.

Of particular importance to airport operations, however, are the draft Contaminated Runway Standards. These regulations impose constraints to operations that will significantly impact some turbojet aircraft, including the B737-200 when operating from contaminated runways of 6,000 feet or less. Since runway extensions to accommodate the regulations is impractical in most cases, it follows that maintenance to remove the contaminant may be the least costly and, perhaps, only available response.

The requirement to certify all airports with scheduled air carrier passenger service will be problematic at some sites which have major physical limitations. The impacts are discussed more fully in Sections 6 and 7.

4.6 Future Medevac Operations

4.6.1 The Medevac Operational Environment

When considering the potential changes and challenges in providing medevac services, the wide array of conditions and situations presented by Northern communities makes any attempt to coin a single standard of service of little value. Conditions and facilities differ widely from site to site and the optimum response at one location may not be for another. Another equally important observation is that despite the universal and well understood desire to move patients to health care facilities as rapidly as possible, medevac requirements alone will seldom, if ever, justify runway extensions. Unless there is a concomitant and demonstrable need to expand facilities for passenger operations, the case for medevac requirements alone is unlikely to be persuasive..

Despite the universal and well-understood desire to move patients to health care facilities as rapidly as possible,medevac requirements alone will seldom, if ever, justify runway extensions.

Unless there is a concomitant and demonstrable need to expand facilities for passenger operations, the case for medevac requirements is unlikely to be economically supportable.

In this regard there are some primary points to be considered. First, many future medevac aircraft types require less runway than those in service now. Second, the main justification cited in support of longer runways is to allow faster aircraft to operate. Yet, it cannot be automatically assumed that higher performance always results in faster response. Many NWT airports are surrounded by high terrain placing rigorous manoeuvring restrictions on aircraft approaching under IFR weather conditions. At many sites, increasing approach speeds result in higher minimum descent altitudes, thereby decreasing the probability of success for the procedure. Indeed, the instrument procedures at some airports are not authorized for use by Category D aircraft, which includes all aircraft with an approach/manoeuvring speed of 141 kt or more. Examples of such airports include, Clyde River, Pond Inlet and Fort McPherson.

4.6.2 Medevac Operations Management

From the above, it is clear that there is a requirement to closely match aircraft performance and operating characteristics with airport conditions. Under some circumstances, it may be possible to airlift patients directly to the point of medical care, while in others it may be necessary to use one type of aircraft to reach a hub airport and then transfer to a higher performance aircraft.

Adding to the integration challenge is the impending establishment of the territory of Nunavut that will bring a new structure of government to mesh with the existing Health Boards. At the same time, it is unlikely that medical evacuation routes and destinations will change significantly as a result of the division. For example, Yellowknife will continue to be the prime care center for the western portions of Nunavut. Close coordination between a variety of agencies will therefore continue to be required.

From both administrative and operational standpoints, therefore, there are compelling reasons to establish centralized management for medevac operations. The functions that would benefit from centralization are listed below.

- Assessing the requirements against available medevac resources and facilities and selecting the most effective response to the site request.
- Tasking and co-ordinating air carrier and supporting agency response.
- Communicating with the site, response teams, regional Hospital/Health Boards, air carriers and ground transportation agencies to integrate and coordinate all information and requirements.
- Coordinating with adjoining jurisdictions, other agencies and the response team to ensure an efficient and timely response.
- Monitoring the situation with respect to weather and other factors that may influence medevac operations.

The complex and dynamic characteristics of medevac suggests that there are significant potential benefits to be gained from centralized management. As discussed above, airport conditions and the air carrier response aircraft type need careful matching to ensure optimum response. Further, by coordinating and integrating the mission with the many agencies involved, opportunities for synergism may also be identified and grasped with consequent time and cost savings.

Considerations of the form and structure of a centralized Medevac management organization is beyond the scope of this study.

Recommendation: That the GNWT undertake a joint analysis with the Nunavut Government to assess options for operational and administrative management of medevac operations.

As discussed in the preceding sections dealing with technology, the growing use of GPS, combined with the emergence of improved performance aircraft, will stand to enhance the reliability and quality of medevac operations. This will be particularly the case for small communities with modest airport facilities and runways of 3,000 feet or less. Those with longer runways already have access to high performance aircraft and reduced transit times.

The new single-engine turbine aircraft such the Cessna Caravan and Pilatus PC-12 represent very significant improvements over the piston-engined aircraft they replace. The PC-12, being pressurized, is already in service with medical authorities in Australia and Brazil. Newer multi-engine jet, and turboprop aircraft in many cases, also bring improved take-off and landing performance, allowing access to small airports not formerly served by these types.

To realize these service improvements it may be necessary to build incentives in the terms and conditions of air carrier contracts. To ensure that appropriate aircraft are available for the area being served, future medevac contracts should contain performance criteria related to each airport with the air carrier being responsible to operate in accordance with all regulations.

Recommendation: That the standards for air medevac carriers be expanded to contain minimum performance requirements for each airport in the area covered by the contract.

4.7 Summary

The factors that impinge on the provision of future air services in the NWT relate to four broad areas:

- Economic changes.
- Changes in Territorial Governance.
- Changes in aircraft and aviation technology.
- Changes in the regulatory environment.

Economic Change

The economy of the NWT is expected to grow at 1.2% per annum to the year 2006. This is about half the expected growth rate for Canada overall. Population is expected to grow 2.1% per annum.

Since airlines operating in the North are now deregulated, airline economics have great influence in the level of service provided. Combi aircraft continue to offer substantial benefits to Northern travellers by sharing operating costs between freight and passengers. Notwithstanding, a market of almost 15,000 annual passengers is required to support daily non-stop B737 combi service. By comparison, 3 times a week Dash 8 combi service requires 1,648 passengers.

Not only does cargo provide a critical transportation service for daily necessities, it also supports passenger air services.

Airfares are linked to load factors with thinly populated areas being at a disadvantage. Again, cargo is a key component in contributing to fixed costs and stabilizing fares.

Territorial Governance

The creation of the Territory of Nunavut will influence future patterns as a result of:

- Decrease in east-west travel to Yellowknife.
- Increased travel to regional administrative centres.
- Increase in total travel.

Aircraft and Aviation Technology - Key Developments

- Replacement aircraft will have improved performance and require less runway.
- GPS will improve overall airport accessibility.

Regulatory Environment – Canadian Aviation Regulation

- Take-off and landing performance requirements will penalize older aircraft.
- Most modern aircraft meet standards.
- Contaminated runway regulations will levy need for maintenance of gravel/pavement runways.

Medevac Operations

- Will benefit from aircraft performance improvements.
- Require matching of aircraft performance to airports for best results.
- Would benefit from centralized management of operations.

[1] The administrative regions that form the NWT are Baffin, Fort Smith, Inuvik, Keewatin, and Kitikmeot.

5. Future Air Services

The existing structure of the NWT air transportation system has evolved from travel demand/patterns of air services that exist in each community, and the supply of services by airlines to meet demand on an economically viable basis. Shaped by technology and operating regulations, the resulting air services network, or routing of individual airlines, largely reflects this demand/supply interaction. Air traffic forecasts are also essential inputs to the development of future air services. The combined effect of these factors lead to the changes or the developments that are expected to structure the future air service network. This section will take a closer look at the demand/patterns that are expected to exist in the NWT through the period covered by this study. As such, air traffic forecasts are provided to characterize future travel demand patterns within the region and in a number of representative communities, and potential route structure changes will be provided.

5.1 Air Traffic Forecasts

Within the NWT air transportation network, certain airports historically play a more essential role than others. The amount of origin/destination air traffic is obviously a determining factor of an airport's role, but the position of an airport within the route structure of the air transportation system, a hub airport for example, is also an important factor. As an input to future air service structure development, forecasts were produced from a representative sample of ten Northern airports, representing close to 73% of total passenger traffic in 1996. This group of airports covers a vast geographical range, from the Western Territory to the Nunavut Territory, and represents the existing administration regions. The ten representing airports consist of Inuvik, Norman Wells, Hay River, Yellowknife, Fort Smith, Cambridge Bay, Rankin Inlet, Resolute, Nanisivik, and Iqaluit.

5.1.1 Forecasting Approach and Methodology

Given the scope of the study and data limitations, a pragmatic and consistent approach was adopted to produce the aviation forecasts. These involve the following steps:

- Examination of historical and current traffic trends;
- Identification of general and community-specific socio-economic activities affecting aviation traffic;
- Identification of airport-specific operating parameters that affect aviation activity;
- Collection/synthesis of information regarding expectation of such factors;
- Review of existing forecasts, if available;
- Consultation of local expertise; and
- Extension/modification of existing forecasts or production of new forecasts.

Due to the lack of cargo statistics and the erratic nature of the data available, there was no attempt to generate cargo forecasts. However, despite the limited cargo data, the study team has incorporated their knowledge of air cargo operations in the NWT into the future air services structure assessment.

5.1.2 Major Forecasting Input Assumptions

Air traffic growth is influenced by macro socio-economic environments and shaped by political/policy changes. The major forecasting input assumptions for this study are:

- Real GDP growth for Western Territory/Nunavut is expected to be 1.23% per annum between 1995-2006, based on Transport Canada/Informetrica (1997).
- For the same period, the NWT Bureau of Statistics projects population growth to be 2.07% per year for the two territories.
- It is assumed that the decentralization of the GNWT and the formation of Nunavut Government organizations would be completed by 2007. Any short-term air traffic fluctuation generated by such activities would be stabilized.
- In addition, airport-specific considerations include:
    - Population growth
    - Passengers/population
    - Average passenger per flight
    - Passenger flights/itinerant aircraft movements mix

5.1.3 Macro Traffic Forecasts

As a whole, passenger traffic at the ten airports is forecast to grow at 2.2% per annum between 1996 and 2007, reaching 585,000 by 2007. Total aircraft movements would increase annually by 1.1% during the same forecasting period, amounting to 162,000 movements in 2007. A forecast range was also generated to account for the uncertainties surrounding the medium forecasts. Detailed individual airport forecasts are presented in Appendix 9. Table 5.1 summarizes forecast air traffic growth.

Table 5.1
Air Traffic Growth, 1996-2007

Regions	Passengers	Total Aircraft Movements
Western Territory*	2.0% p.a.	1.1% p.a.
Nunavut**	2.5% p.a.	1.1% p.a.
Total	2.2% p.a.	1.1% p.a.

* Includes Inuvik, Normal Well, Hay River, Yellowknife and Fort Smith.
** Includes Cambridge Bay, Rankin Inlet, Resolute, Nanisivik and Iqaluit.

The forecasts indicate that as a group, passenger traffic growth for airports in the Western Territory is lower than that of Nunavut airports. In addition, passenger growth is slower than demographic increases in the Western Territory, but faster than population growth in Nunavut. With the formation of Nunavut, political and business interaction between the Eastern Arctic and the rest of Canada, particularly the Federal government, is expected to increase and become more direct.

Passenger traffic growth at airports in the Western Territory is expected to be lower than that of the Nunavut airports.

Political and business interaction is expected to grow between the Eastern Arctic and the rest of Canada

The comparison of aircraft movement forecasts is somewhat affected by current facility deficiencies at certain airports (Hay River and Fort Smith) in the Western Territory. These deficiencies – mainly the lack of refuelling facilities that led to a decline in aircraft activity at these sites – are expected to get resolved in the future. Both airports are assumed to recapture most of the lost traffic due to the lack of facilities, and thus show higher growth rates than otherwise justified.

The overall forecasts together with individual airport forecasts provide guidance to the magnitude and geographical distribution of traffic growth. These forecasts will be an essential input to determine the future air services. The expected overall traffic growth, however, does not appear to be sufficiently large to support significant increase in future air services. Furthermore, it has been reinforced by the air carrier surveys that most carriers do not expect expanded scheduled services in the NWT.

There are two types of hubs within the Northern Air Transportation System:

Gateway hubs
Regional hubs

5.1.4 Aviation Forecasts at Hub Airports

As discussed earlier, within the air services network system, some airports play an essential role either as a major connecting point for the network, or as an en route airport to serve other airports of less traffic demand. Airports serving such a role are designated as hubs in the network system. There are two types of hubs within the northern air transportation system, Gateway Hubs and Regional

Hubs. The remaining facilities will be known as Community Airports. The rest of this section describes the annual aviation forecasts for each of the hub airports. Planning peak forecasts are derived forecasts at the next level of detail. Although essential for facility planning, planning peak analysis is outside the scope of this study.

5.1.4.1 Gateway Hub Forecasts

The gateway hub airports provide the trunk air services links with southern Canada and are thus the critical component in the network system. These hubs process the majority of passengers and cargo, and their efficiency is critical to system efficiency. Gateway Hubs include Yellowknife Airport, Rankin Inlet Airport and Iqaluit Airport.

Gateway Hubs provide the trunk air service links with southern Canada

5.1.4.1.1 Yellowknife Airport (YZF) Aviation Forecasts

Community Profile

Yellowknife is the capital of the Northwest Territories and is home to 17,000 people. Territorial, Federal, and Municipal governments are the city's largest employers although gold mining, having created much wealth for the city, serves as the foundation for the local industrial economy. The city has also become a beacon for tourism, whether it be local or to points northward. With the formation of Nunavut, Yellowknife will remain the capital of the Western Territory.

Air Traffic Characteristics

Yellowknife Airport is a Gateway Hub in the Northwest Territories air network. Historically, about 12% of the passengers at YZF are connecting to other airports. In 1996, the Yellowknife Airport handled 213,287 enplaned/deplaned passengers. The top origin/destination market was Edmonton with 20,320 passengers, followed by Calgary (10,990 passengers) and Vancouver (8,180 passengers). Currently, seven airlines offer about 170 weekly scheduled non-stop flights from Yellowknife to seventeen markets. The air services network involving YZF as a Gateway Hub is depicted in Section 2. More details of the current level of air services are listed in Appendix 1. Of the 62,881 total aircraft movements recorded in 1996, there were 38,801 itinerant movements with the balance as local movements.

Factors Affecting Aviation Activity

The major factors that will affect future aviation activity at the Yellowknife airport are:

- The downsizing and decentralization of the Government of the Northwest Territories.
- The formation of Nunavut that will lead to less administrative interaction between Yellowknife and some regional centres such as Cambridge Bay and Rankin.
- The suspension of activities at the Lupin Mine.
- The discovery of diamond reserves in the area, and the opening of the proposed BHP Diamond Mine and Diavik Mine.
- Yellowknife positioning itself as a major service centre for the Northwest Territories with nationally priced goods, attracting shoppers who would otherwise go to Edmonton

- The Development of tourism activities.

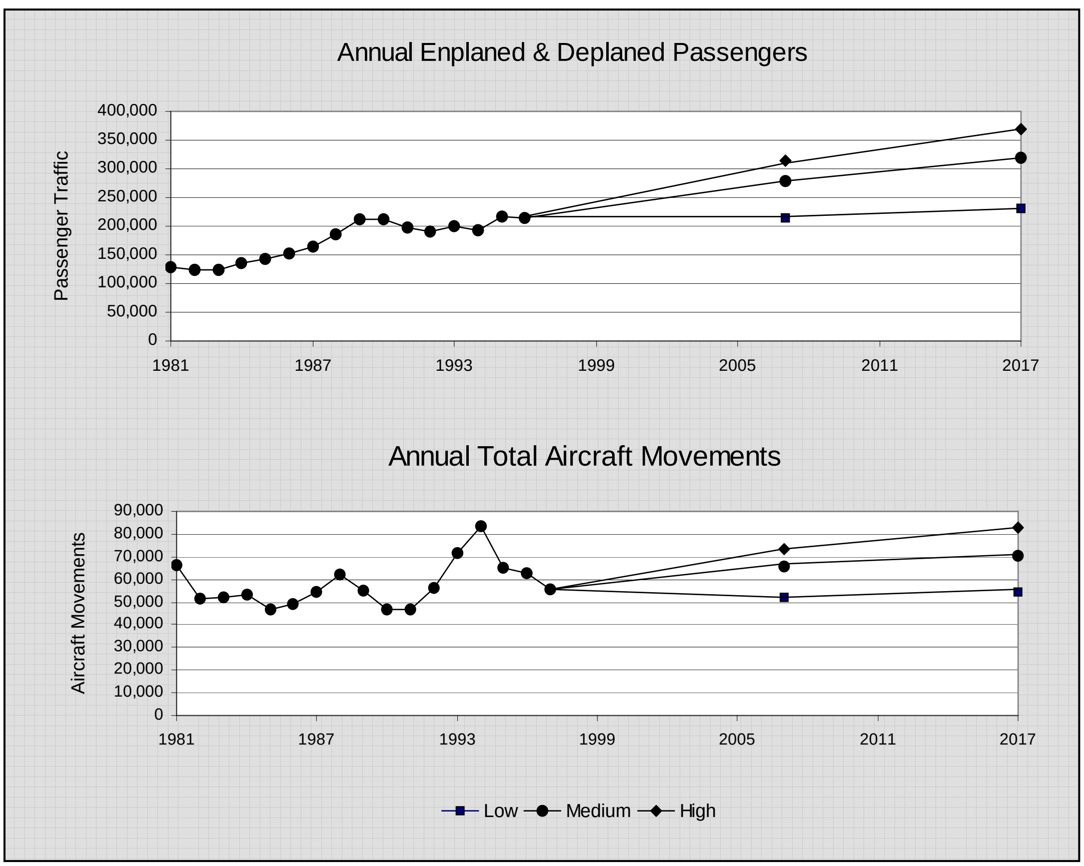
Aviation Forecasts

Enplaned and deplaned passenger traffic is expected to grow at 2.4% per annum between 1996-2007. Total aircraft movements are forecast to increase at a much lower pace. Route rationalization and the stabilisation of exploration-related movements would result in modest growth to aircraft traffic.

Table 5.2
YZF Aviation Forecasts

Year		Enplaned/Deplaned Passengers	Total Aircraft Movements
1994		192,498	83,281
1995		217,169	65,340
1996		213,287	62,881
	Low	215,000	52,000
2007	*Medium*	278,000	66,000
	High	314,000	73,500
	Low	230,000	54,500
2017	*Medium*	320,000	70,500
	High	370,000	82,000

Figure 5.1
Air Traffic Forecasts: Yellowknife Airport



5.1.4.1.2 Rankin Inlet Airport (YRT) Aviation Forecasts

Community Profile

Rankin Inlet, a community of 2,058 people, serves as the administration and transportation centre of the Keewatin Region, and has been designated as the regional centre for the Kivalliq (Keewatin) Region of Nunavut. The government sector plays a primary role in the community's economy. Other economic activities include transportation/communication, commercial fishing, tourism, and traditional activities. There is no permanent road access to Rankin Inlet. Most basic necessities are transported to the community via the annual sealift or by air. Passenger travel is almost exclusively dominated by the air mode.

Air Traffic Characteristics

Rankin Inlet Airport is a Gateway Hub in the Northwest Territories air network. In the late 1980s, YRT replaced Churchill as carriers' choice connecting point on the East-West route corridor and to the South. Today, Rankin Inlet Airport still functions as the major hub connecting Yellowknife and Iqaluit. In addition, it serves Winnipeg with direct air service and acts as a mini-hub for the coastal markets in the Keewatin Region. In 1996, there were 34,428 enplaned/deplaned passengers at YRT. The top origin/destination market was Yellowknife with 1,230 passengers, followed by Iqaluit (810 passengers) and Toronto (730 passengers). Currently, five airlines offer about 60 weekly scheduled non-stop flights from YRT to nine markets. Section 2 already depicted the air services network involving YRT as a Gateway Hub. There were 9,452 total aircraft movements in 1996, including 9,432 itinerant movements.

Factors Affecting Future Aviation Activity

The major factors affecting future aviation activity at the Rankin Inlet Airport are:

- Increased Government administration interaction between Rankin Inlet, a regional centre for Nunavut, and the capital, Iqaluit, but decreased interaction with Yellowknife.
- An expected positive net impact on government employment resulting from the decentralized structure of the Nunavut Government (Section 4, Table 4.2).
- A strengthened regional role would increase the propensity to travel
- The potential for minerals exploration – for example, the WMC Meliadine Lake site (20 km. west of Rankin Inlet), rich in gold deposits - may become a mine depending on market conditions.

Aviation Forecasts

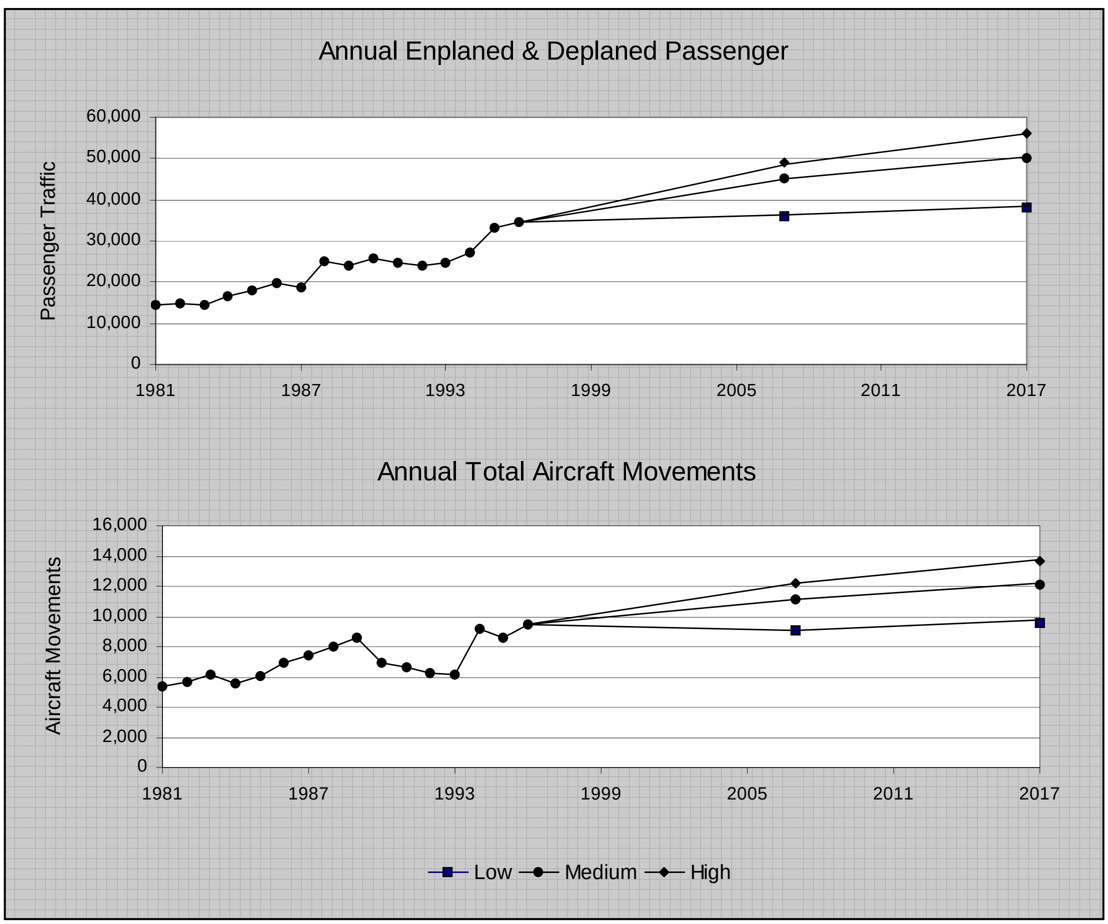
Enplaned and deplaned passenger traffic is forecast to grow at 2.5% per annum between 1996-2007. Total aircraft movements are expected to increase at a lower rate of 1.5% per year. Local movements remain non-substantial.

Table 5.3

YRT Aviation Forecasts

Year		Enplaned/Deplaned Passengers	Total Aircraft Movements
1994		27,084	9,152
1995		33,273	8,575
1996		34,428	9,452
	Low	36,000	9,050
2007	*Medium*	45,000	11,100
	High	49,000	12,200
	Low	38,000	9,550
2017	*Medium*	50,000	12,100
	High	56,000	13,700

Figure 5.2
Air Traffic Forecasts: Rankin Inlet Airport



5.1.4.1.3 Iqaluit Airport (YFB) Aviation Forecasts

Community Profile

Iqaluit, with its population of 4,220 people, has historically been the regional centre of the Baffin Region. The community's economy is based primarily on government and related services such as health and education. Other economic activities include transportation, tourism, marine mammal and game harvesting. There is no direct road access to Iqaluit. An annual sealift in the summer brings in most bulk cargo and basic necessities, including canned goods. Substantial amount of perishable cargo is shipped by air on a regular basis. With the establishment of Nunavut, Iqaluit will become the new capital in 1999. Government presence will undoubtedly increase, as well as related employment and population.

Air Traffic Characteristics

Iqaluit Airport is the Gateway Hub in the Eastern Arctic providing air linkages between Baffin communities and the South. It also anchors the east end of the major East-West route corridor. There were 71,967 enplaned/deplaned passengers handled by Iqaluit Airport in 1996. The top origin/destination markets have historically been Montreal, Ottawa and Toronto, which in 1995 generated 3,370, 2,290, and 1,880 passengers, respectively. Currently, five airlines serve sixteen markets with about 60 weekly scheduled non-stop flights from Iqaluit. The airport had 18,150 total aircraft movements in 1996, of which 16,424 were local movements.

Factors Affecting Future Aviation Activity

The major factors affecting future aviation activity at the Iqaluit Airport are:

- New/increased government administration interaction between Iqaluit, the designated capital of Nunavut, and the Nunavut regional centres. Business with the rest of Canada, particularly the Federal Government will also increase, as well business travel.
- Iqaluit receiving the largest absolute increase in new government jobs, (164 – see Section 4, Table 4.2).
- A population expected to grow by almost 500 in the next few years.
- The community's potential to evolve to a centre for Pan-Arctic diplomacy, science and tourism.

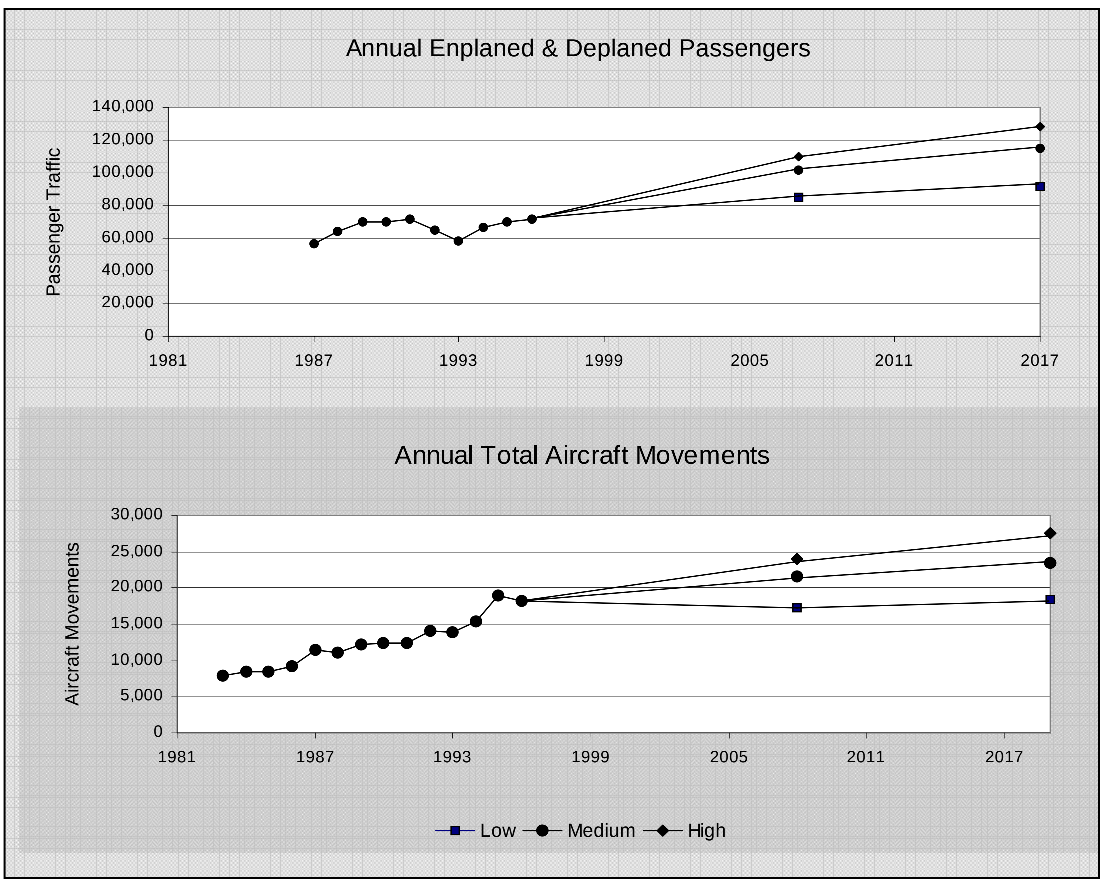
Aviation Forecasts

Between 1996-2007, enplaned and deplaned passenger traffic is forecast to grow annually at 3.2%, even from a historical high traffic base. More moderate growth, at 1.6% per year, in total aircraft movements are expected, influenced by general aviation and local movement activities.

Table 5.4
YFB Aviation Forecasts

Year		Enplaned/Deplaned Passengers	Total Aircraft Movements
1994		66,509	15,329
1995		69,656	19,012
1996		71,967	18,150
	Low	85,000	17,300
2007	*Medium*	102,000	21,600
	High	110,000	24,000
	Low	92,000	18,300
2017	*Medium*	115,000	23,500
	High	128,000	27,500

Figure 5.3
Air Traffic Forecasts: Iqaluit Airport



5.1.4.2 Regional Hub Forecasts

The Regional Hub airports are jet-capable distribution points for passengers and cargo to the Community Airports they serve. Typically, the regional hubs are located at the region's administrative centre, and are also a focal point for medevac flights. Inuvik, Norman Wells, Cambridge Bay and Resolute Airports form the network of Regional Hub airports serving other community airports.

Regional Hubs are distribution points for passenger and cargo to Community Airports

5.1.4.2.1 Inuvik Airport (YEV) Aviation Forecasts

Community Profile

Inuvik, with a population of 3,296 people, is the administrative centre of the Inuvik Region, and is a major transportation, health and education service point. Together with government services, these activities account for the economic base of the community. With the discovery of oil in the Beaufort Sea, Inuvik became the staging platform for oil and gas exploration. The Dempster Highway provides access to Inuvik via Dawson City in the Yukon. There are winter roads linking Aklavik and Tuktoyaktuk. Barge service from Hay River operates in the summer.

Air Traffic Characteristics

Inuvik Airport is a regional hub in the NWT air network providing non-stop services to the Yellowknife Gateway Hub, and serving the northern communities in the Inuvik Region, including the remote community of Sachs Harbour. Currently, seven airlines offer about 50 weekly scheduled non-stop flights from Inuvik to nine markets. The airport handled 47,822 enplaned/deplaned passengers in 1996. The top origin/destination market was Yellowknife with 6,020 passengers, followed by Edmonton (5,310 passengers) and Norman Wells (1,750 passengers). There were 13,037 itinerant aircraft movements and 1,231 local movements recorded in 1996, to a total of 14,268 movements.

Factors Affecting Future Aviation Activity

The major factors affecting aviation activity are:

- The nature of government cutbacks and how the community would withstand them – the community had weathered the Canadian Forces base closure in 1986 that resulted in a blow to the local economy
- The preservation of the regional role and hub status at the airport would serve the basic demand to travel and gradually recover some traffic.
- The potential for more substantial growth would depend on oil and gas exploration in the Beaufort Sea.

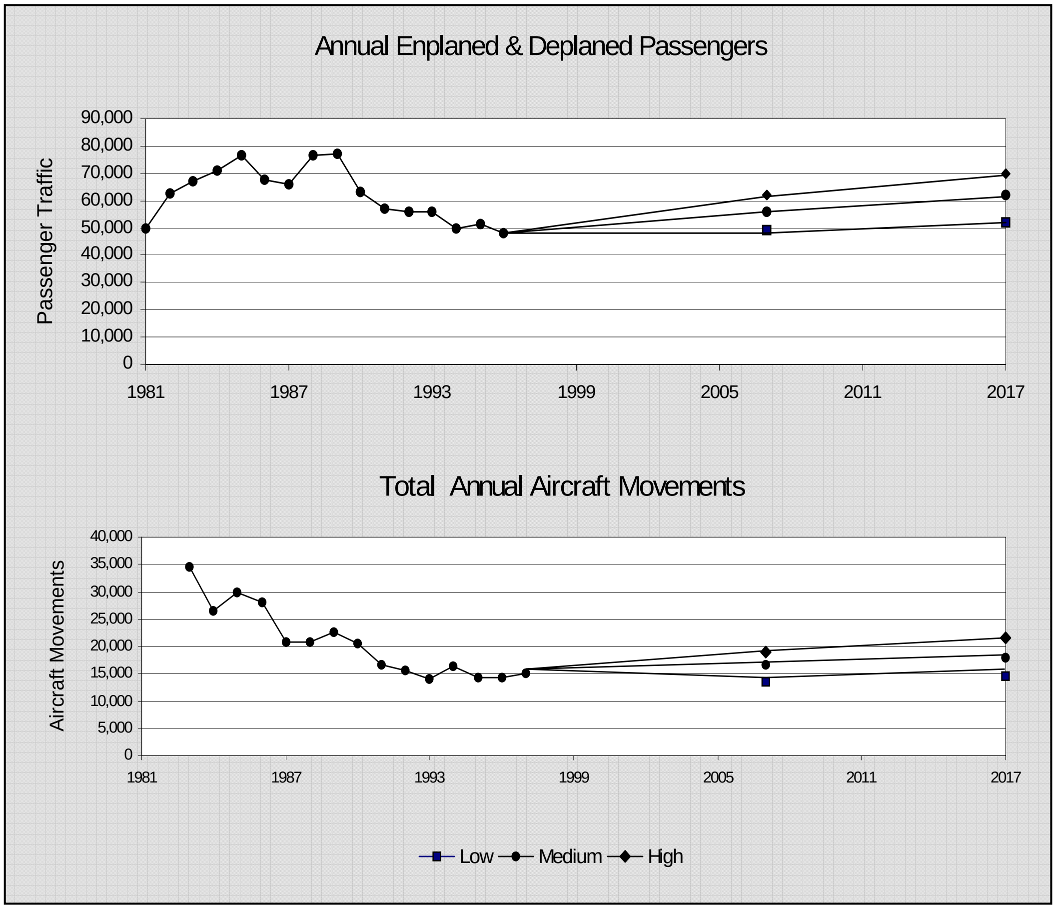
Aviation Forecasts

Enplaned and deplaned passenger traffic is forecast to recover at 1.4% per annum between 1996-2007. Total aircraft movements are expected to increase at a similar rate of 1.3% per year.

Table 5.5
YEV Aviation Forecasts

Year		Enplaned/Deplaned Passengers	Total Aircraft Movements
1994		49,502	16,246
1995		51,737	14,177
1996		47,822	14,268
	Low	49,000	13,500
2007	*Medium*	56,000	16,500
	High	62,000	19,000
	Low	52,000	14,500
2017	*Medium*	62,000	18,000
	High	70,000	21,500

Figure 5.4
Air Traffic Forecasts: Inuvik Airport



5.1.4.2.2 Norman Wells Airport (YVQ) Aviation Forecasts

Community Profile

Norman Wells is an economically self-reliant community of about 800 people. Its main economic activity continues to be oil drilling and exploration. Imperial Oil Ltd. produces over one million barrels of crude oil per year from the site. Esso's Norman Wells oil field is Canada's fourth largest producing field in terms of remaining reserves. Access to Norman Wells is limited to a winter road from Wrigley and barge service in the summer. Air transportation serves passenger travel demand almost exclusively.

Air Traffic Characteristics

Norman Wells Airport is a Regional Hub serving communities along the Mackenzie River. It is the major enroute/connecting point for the North-South route corridor in the area, providing jet service to the Yellowknife Gateway Hub. Currently, Canadian North and North-Wright Air offer about 35 weekly scheduled non-stop flights from Norman Wells to five markets. In 1996, there were 26,581 enplaned/deplaned passengers going through the airport. The top origin/destination market was Edmonton with 5,990 passengers, followed by Yellowknife (3,240 passengers) and Calgary (2,200 passengers). The airport handled 14,924 total aircraft movements in the same year, of which 12,209 are itinerant movements.

Factors Affecting Future Aviation Activity

The major factors affecting future aviation activity at the Norman Wells Airport are:

- The stability of the oil and gas industry, particularly the operations in Norman Wells – passenger traffic has been relatively stable for the past decade.
- The development of a pipeline northward from Norman Wells to the oil/gas rich Mackenzie Delta/Beaufort Sea. This development would certainly create new demand growth, but the potential remains uncertain as current market conditions do not warrant the development.
- The completion of the Mackenzie Highway from Wrigley to Inuvik and Tuktoyaktuk. This project would increase mobility and business opportunities, lower transportation costs for resupply along the Mackenzie Valley, but might divert some air traffic from the Norman Wells Airport.

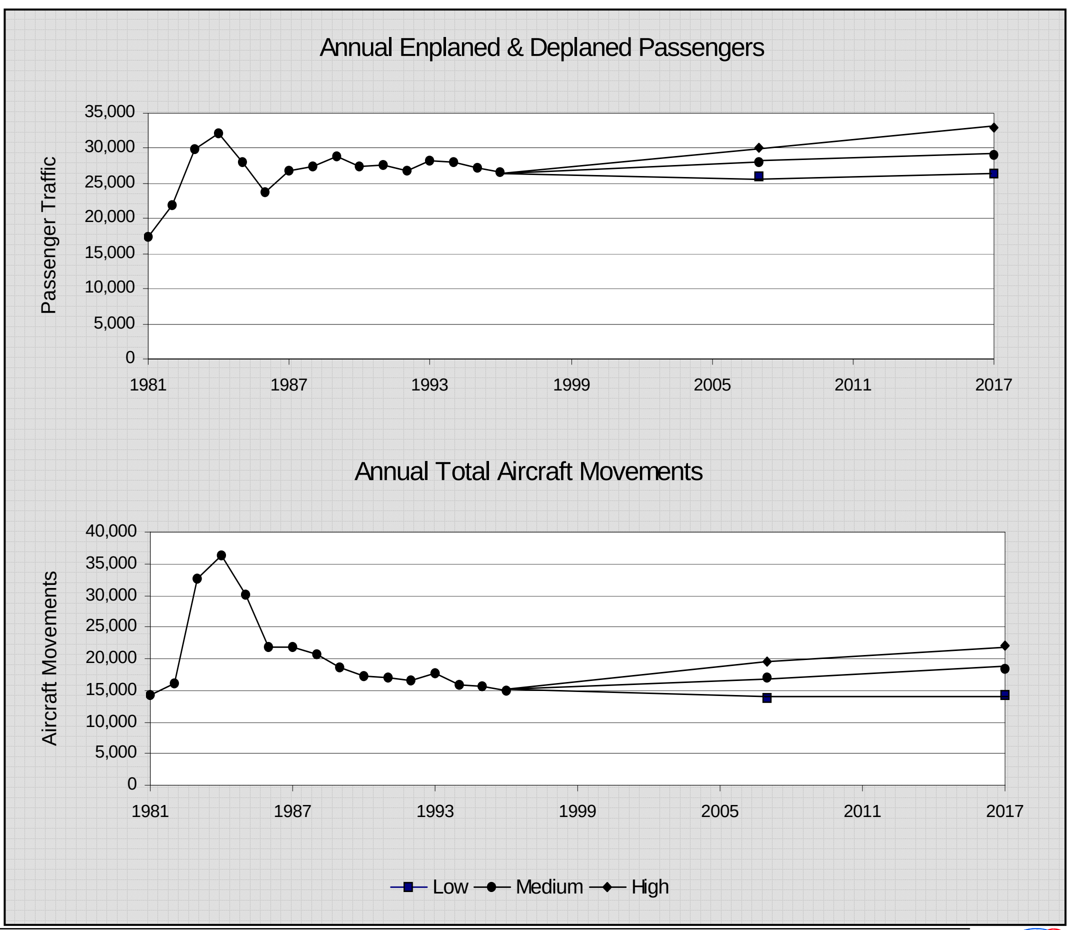
Aviation Forecasts

From 1996 to 2007, enplaned and deplaned passenger traffic is forecast to rebound at 0.5% per year. Total aircraft movements are expected to recover at a slightly higher annual rate of 1.2%.

Table 5.6
YVQ Aviation Forecasts

Year		Enplaned/Deplaned Passengers	Total Aircraft Movements
1994		28,026	15,811
1995		27,315	15,594
1996		26,581	14,924
	Low	26,000	13,800
2007	*Medium*	28,000	17,000
	High	30,000	19,500
	Low	26,500	14,300
2017	*Medium*	29,000	18,500
	High	33,000	22,000

Figure 5.5
Air Traffic Forecasts: Norman Wells Airport



5.1.4.2.3 Cambridge Bay Airport (YCB) Aviation Forecast

Community Profile

Cambridge Bay, a community of 1,188 people is the administrative centre of the Kitikmeot Region. Government programs/employment and traditional subsistence pursuits have been behind the community's economy, supplemented by other businesses such as the Royal Bank and the local fish and meat plant that was recently expanded. Cambridge Bay is an isolated community with no road access. Bulk and non-perishable goods are supplied by sealift. Perishable goods are shipped by air. Passenger travel is almost exclusively dominated by the air mode. Cambridge Bay has been designated the regional centre for this region of the new Nunavut.

Air Traffic Characteristics

Cambridge Bay Airport is a Regional Hub serving the smaller communities in the region, and linking them to the Yellowknife Gateway Hub. Currently, Canadian North, First Air, and NWT Air provide 20 weekly scheduled non-stop flights from Cambridge Bay to three markets. There were 11,592 enplaned/deplaned passengers handled at the airport in 1996. The top origin/destination markets were Yellowknife and Edmonton, which contributes to 750 and 450 passengers, respectively. There were 4,804 total aircraft movements for the year with minimal local movements.

Factors Affecting Future Aviation Activity

The major factors that will affect future aviation activity at the Cambridge Bay Airport are:

- Increased interaction of government administration between Cambridge Bay, a regional administrative centre in Nunavut, and Iqaluit and other Nunavut regional centres, but decreased interaction with Yellowknife.
- An expected positive net impact on government employment (Section 4, Table 4.2).
- A strengthened regional role would increase the propensity to travel.
- The rationalization of services that may happen, and the new/increased services to other Nunavut markets that are expected.

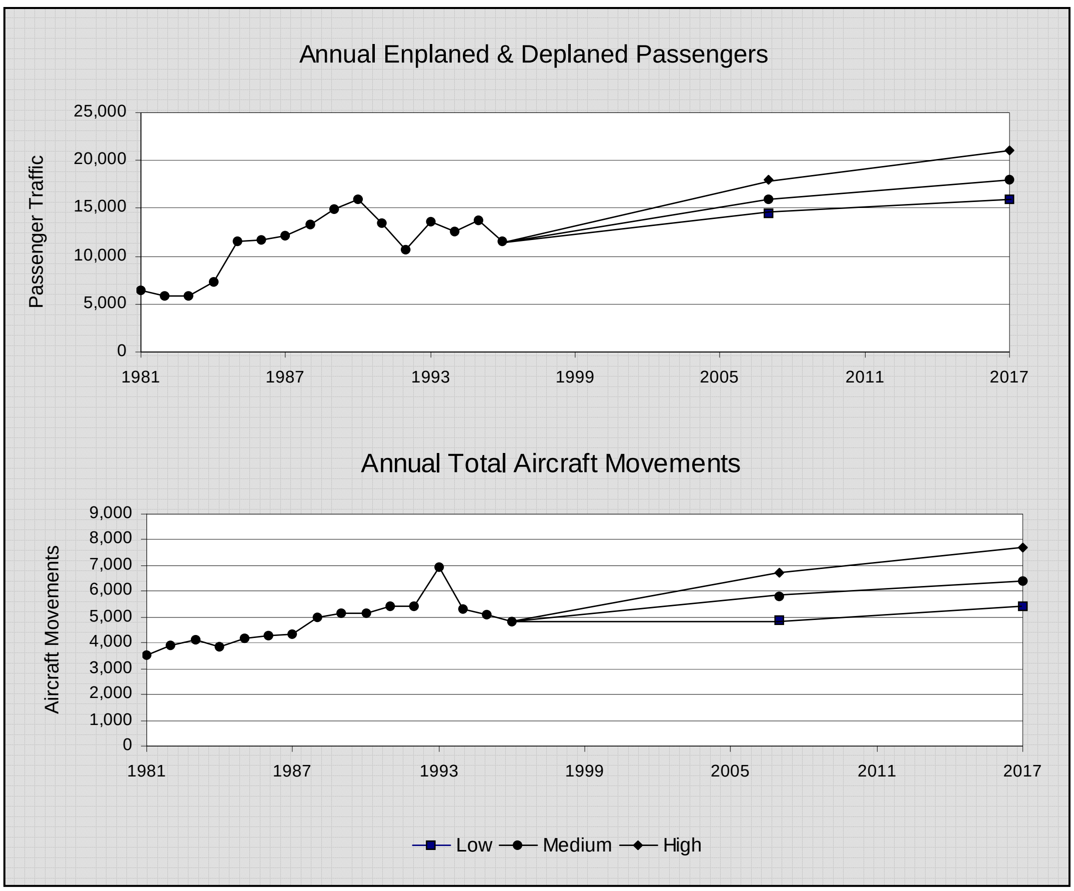
Aviation Forecasts

Enplaned and deplaned passenger traffic is forecast to grow annually at 3.0% between 1996-2007, from a smaller traffic base. Total aircraft movements are expected to increase at a lower rate of 1.7% per year. Local movements remain non-substantial.

Table 5.7
YCB Aviation Forecasts

Year		Enplaned/Deplaned Passengers	Total Aircraft Movements
1994		12,537	5,294
1995		13,815	5,097
1996		11,592	4,804
	Low	14,500	4,810
2007	*Medium*	16,000	5,800
	High	18,000	6,700
	Low	16,000	5,400
2017	*Medium*	18,000	6,400
	High	21,000	7,700

Figure 5.6
Air Traffic Forecasts: Cambridge Bay Airport



5.1.4.2.4 Resolute Airport (YRB) Aviation Forecasts

Community Profile

Resolute Bay is a unique community of about 200 people. It displays economic and transportation characteristics more closely associated with a larger northern community. Over the years, it developed into a major transshipment point for the supply of petroleum exploration equipment to points northward. Although traditional pursuits are the community's major economic activity, the Cominco Polaris Mine on Little Cornwallis Island, some 200 km to the north, also generates economic and transportation activity. Within the community, traditional pursuits are the major economic activity, augmented by some eco-tourism. On-going crew exchanges at the Polaris mine depend on and provide traffic for air services operations. Eco-tourism, military activities, geological surveys and other scientific research also generate aviation demand and aircraft movement activity.

Air Traffic Characteristics

Resolute Airport is a Regional Hub, mostly because of its strategic location. The airport serves communities in the far North and anchors direct services with both the Iqaluit and Yellowknife Gateway Hubs. Currently, Canadian North, First Air, and Kenn Borek Air provide about ten weekly non-stop scheduled flights from Resolute to four destinations. In 1996, there were 10,576 enplaned/deplaned passengers going through the Resolute Airport. Edmonton remained the top origin/destination market with 1,760 passengers followed by Calgary (760 passengers) and Toronto (640 passengers). Itinerant aircraft movements accounted for 5,629 of the total 5,855 movements.

Factors Affecting Future Aviation Activity

The major factors that will affect future aviation activity at the Resolute Airport are:

- The announced closure of the Cominco mine by 2001, which will result in a considerable loss of traffic.
- The development of other economic activities that may enable Resolute Airport to recapture some traffic in the longer term.
- The expected continuation of operations at the airport because of its strategic location in the Canadian Arctic.

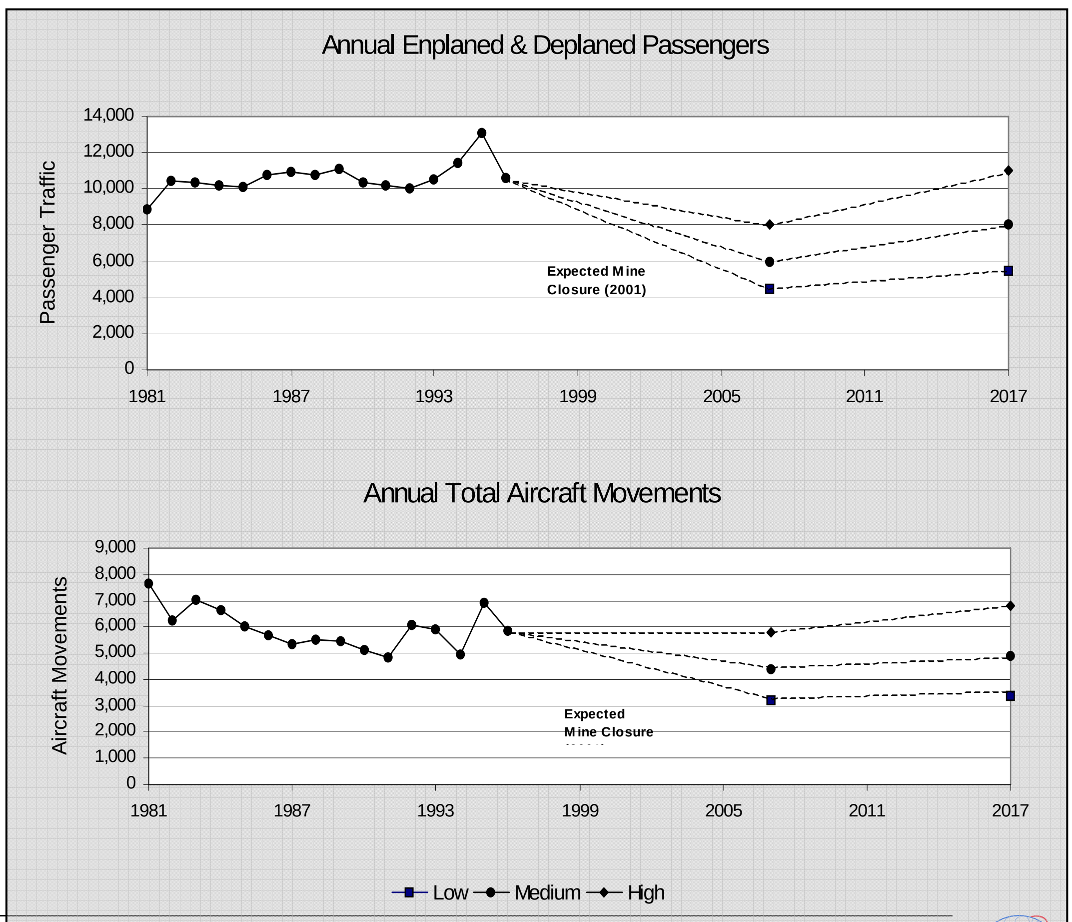
Aviation Forecasts – Order-of-Magnitude

Enplaned and deplaned passenger traffic is forecast to decline drastically due to the mine closure, and rebounds to only about 40% of the current level by 2007. The impact on aircraft movements is not expected to be as great, due to other activities not related to passenger traffic.

Table 5.8
YRB Aviation Forecasts

Year		Enplaned/Deplaned Passengers	Total Aircraft Movements
1994		11,449	4,978
1995		13,124	6,898
1996		10,576	5,855
	Low	4,500	3,200
2007	*Medium*	6,000	4,400
	High	8,000	5,800
	Low	5,500	3,400
2017	*Medium*	8,000	4,900
	High	11,000	6,800

Figure 5.7
Air Traffic Forecasts: Resolute Airport



5.2 Future Air Services Route Structure

The future air services structure in the North will largely reflect the demand/supply created by the factors discussed in the previous Sections. With a deregulated air transportation industry, Northern air carriers are expected to play a larger role in the development of air services to Northern communities as the industry responds to marketplace demands.

Overall, the current operating patterns, with the types of operations and level of service described in Section 2, enables air carriers to provide additional service without straining the system. For example, greater passenger capacity can be attained through the addition of flights with current aircraft and adjusting seat configuration to optimize passenger/cargo demand patterns. Also, multi-stop service can be changed to more direct, non-stop flights but with an increase in the number of flights from each community served by the previous service.

5.2.1 Potential Route Structure Changes

Therefore, on the basis of forecast traffic growth and the air carrier survey results, the air service route network, with some exceptions, is expected to remain as it is today. It is expected however that the demand for air travel will grow in the Western Territory and Nunavut, but not at a phenomenally fast pace. This will result in minor adjustments to levels of service and the introduction of a few new air service routes in certain regions. Figure 5.8 shows the anticipated future route network and highlights the expected new routes.

The air service route network, with the following exceptions, will likely have the same outlines as it has today

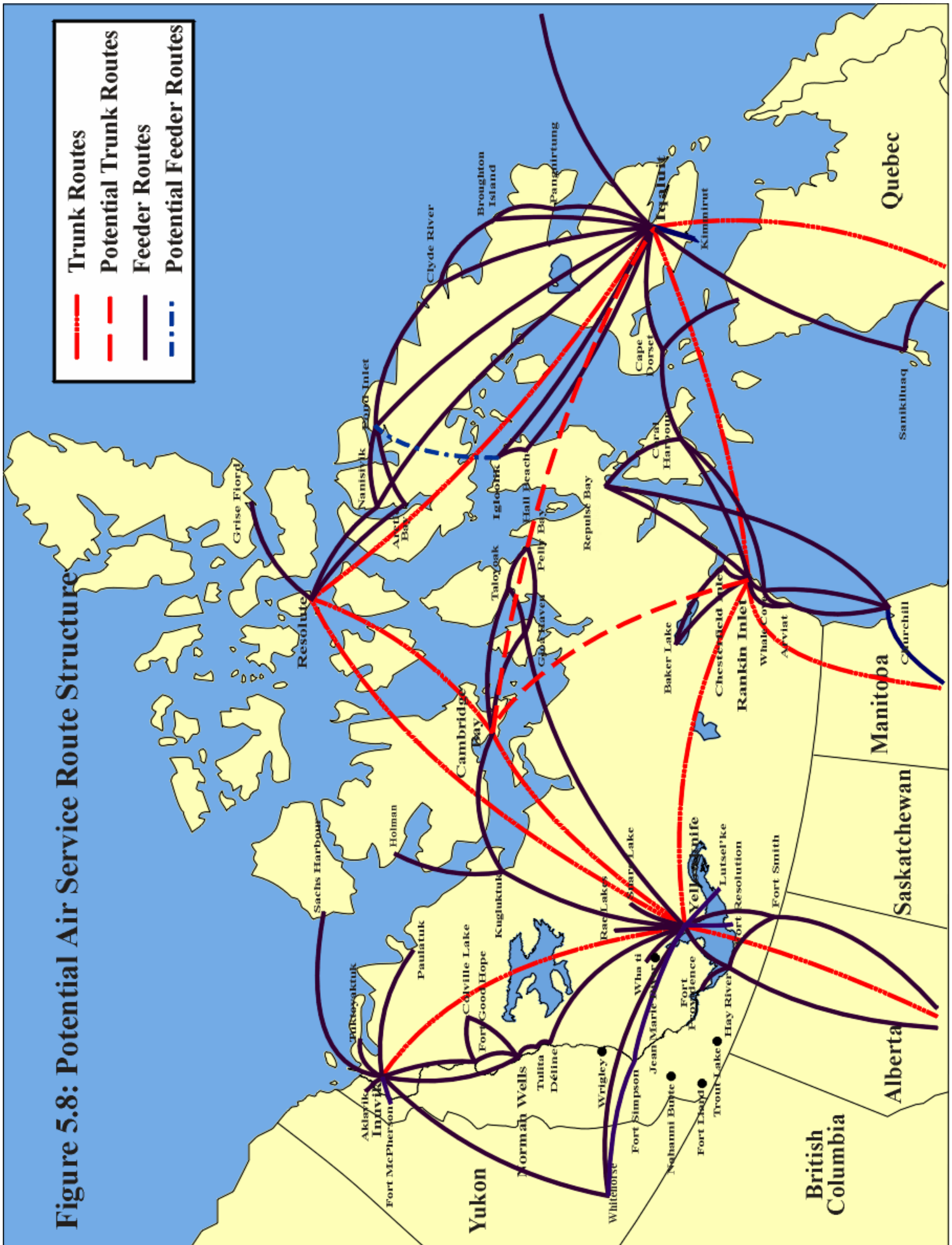
5.2.1.1 Growth Routes

The following routes may witness more rapid flight frequency growth than others:

- Igloolik – Hall Beach
- Pangnirtung – Iqaluit
- Pond Inlet – Iqaluit
- Arviat – Churchill
- Arviat – Rankin Inlet
- Baker Lake – Rankin Inlet
- Whale Cove – Rankin Inlet

Figure 5.8

Potential Air Service Route Structure



5.2.1.2 Future Route Development

Evolving regional air traffic demand patterns resulting from the socio-economic and political development in the new Nunavut Territory are expected to stimulate the introduction of new air service routes over the long-term period by Northern air carriers. These routes are: Rankin Inlet – Cambridge Bay; Cambridge – Iqaluit; Igloolik – Pond Inlet.

Potential Route Development
Long-Term (20 years)

Rankin – Cambridge
Cambridge – Iqaluit
Igloolik – Pond Inlet

Rankin Inlet – Cambridge Bay

Direct air service may be introduced between Rankin Inlet and Cam bridge Bay in the not too distant future. This route would link the two regional government centres and would provide a faster routing for Iqaluit – Cambridge Bay passengers who currently must fly via a rather circuitous, northerly (Resolute) routing to make the journey. With the government centre located in Iqaluit, and a regional office in Cambridge Bay, the travel demand between these two communities is expected to grow rather rapidly.

Cambridge Bay – Iqaluit

The likelihood of this routing being introduced in the short-term is minimal but as the new Nunavut government expands, populations grow, and traffic builds up over the Rankin Inlet routing, a direct service may be feasible in the longer term.

Igloolik – Pond Inlet

Direct service between Igloolik and Pond Inlet is nonexistant. Since these communities are respectively designated as regional and auxiliary regional centres, some air traffic demand is expected to be created over the long-term period. Currently, travellers must back-haul through Iqaluit to get from one community to the other. The link between the other two auxiliary centres, Pangnirtung and Cape Dorset, and the Igloolik regional office is also a back-haul via Iqaluit, but the distances covered are not as great as with Igloolik and Pond Inlet.

5.3 Summary

Based on forecast traffic growth and air carrier survey results, the air service structure in the Northwest Territories is expected to remain as it is today with a few exceptions.

Air Traffic Forecasts
Air traffic forecasts indicate that overall air travel will grow in the North but not a phenomenally fast pace. Passenger growth at the ten airports, representing 73% of the total Northern passenger traffic in 1996, is forecast at 2.2% per annum. Total aircraft movements would increase annually by 1.1% during the same forecast period. Passenger growth is forecast to increase more in the Nunavut Territory.

Between 1996-2007, enplaned and deplaned passenger traffic increases at Gateway Hub airports is forecast to range from 2.4% to 3.2%. Aircraft movements are forecast to increase at a much lower pace.

The forecast air traffic at the Regional Hub airports will vary depending on the socio-economic characteristics that are specific to each community.

Future Air Services Route Structure
Minor adjustments to levels of service and the introduction of a few new air service routes are expected in certain regions.

The following routes may witness more rapid flight frequency growth than others:

- Igloolik – Hall Beach
- Pangnirtung – Iqaluit
- Pond Inlet – Iqaluit
- Arviat – Churchill
- Arviat – Rankin Inlet
- Baker Lake – Rankin Inlet
- Whale Cove – Rankin Inlet

Potential route development is expected on the following route segments:

- Rankin Inlet – Cambridge Bay
- Cambridge – Iqaluit
- Igloolik – Pond Inlet

6. NWT Airport Planning

6.1 Introduction

The critical role played by air transportation in the Arctic presents a challenging set of conditions for airport planning. For many communities the airport may be, for all or part of the year, the only transportation link. At the same time, the relatively sparse population spread over long distances imposes demanding performance criteria on air carriers, both from operational and economic standpoints.

The characteristics of the Northern aviation environment, combined with the dependency on air services, requires most airports to adopt a different approach to airport planning than that typical of southern Canada with larger populations linked by surface transportation systems. In the South, for example, small community airports serving a population of 500 are rarely subject to detailed planning and analysis. Seldom are these airports critical to access and, in many instances, recreation rather than transportation is the objective of their primary activity. For Northern airports, the situation is quite different with even the smallest community airports requiring operational evaluation and planning.

The limited resources available for operation of the system make it increasingly important that infrastructure investment decisions be based on sound economic considerations. Safety is of course the first priority. Safety, however, depends on an amalgam of factors that, in combination, result in a safe operating environment.

The limited resources available for operation of the system make it increasingly important that infrastructure investment decisions be based on sound economic considerations.

Runway extensions, for example, may not result in any improvement in operating margins if surrounding terrain or obstacles present operational limitations. The application of the *Net Take-off Flight Path* regulations is a new factor to be considered in this regard. Other factors with a fundamental link to safety include airfield maintenance, communications, navigation aids, instrument approach and departure procedures, aircraft performance, fuel availability and weather observations.

A key consideration is the role played by the airport in the overall system.

With respect to the economic justification for a runway expansion, it is essential that the analysis supporting the project provide a clear indication that the expansion will result in sustained improvement in level of service. As in all competitive markets, excess aircraft capacity cannot long be tolerated because of the corresponding economic penalty exacted by inefficient use of capital intensive resources.

This section examines the current classification of GNWT airports, and sets out a methodology of planning that relates to the airport's role within the overall system.

6.2 The GNWT Airport Classification System

GNWT Airports are currently assigned a Category and a Classification Index. The classification system was first introduced under the Federal "Policy for Provision of Air Transportation Facilities and Services in the Yukon and Northwest Territories" (1974). The policy introduced three categories of airports – Arctic A, B and C – to which the GNWT later added a fourth – Arctic D. The category assignment was somewhat broadly based on activity and population size.

Each category provided for a minimum standard of facilities including runway, communications and navigation aids, and passenger terminals or shelters. With respect to runways, the following standards were adopted:

Arctic	A:	6,000 x 150 feet (minimum)
Arctic	B:	5,000 x 150 feet
Arctic	C:	3,000 x 100 feet
Arctic	D:	2,500 x 100 feet

These standards were not always attained in practice due to terrain problems and the very high cost of construction.

In 1993, the GNWT Department of Transportation revised the classification system by basing it on a formula that produced a Classification Index. The Index took into account the following factors:

- Passenger traffic volumes
- Number of aircraft movements
- Airport role
- Connections to other airports
- Type of aircraft serving the airport
- Remoteness
- Availability of other transportation modes to the community

The application of the Index realigned the categories and shifted airport classifications according to changes that had taken place since the original Arctic Facilities Policy designation. Appendix 10 contains a more complete overview of the components.

Although the adoption of the Index provided a means of reflecting the changing activity and relative ranking of the airports in the system, the indices do not provide the information required to assess the required runway length at a particular airport. This is because the Index still results in the arbitrary assignment of runway length as a function of inclusion in a classification rather than as a result of the actual demand and site operating characteristics. In practice, the runway lengths associated with the classification system have not always been appropriate: some sites cannot accommodate the length of runway associated with their category; in other cases, runways are longer than justified by the demand and aircraft type providing service. The classification system, therefore, is not judged to be an appropriate methodology for the evaluation of specific site runway requirements.

Because the Classification Index is predicated upon the current situation and activity at a site, it is not an appropriate tool for evaluating emerging or forecast requirements for an airport. The justification of major capital expenditures depends heavily on forecast traffic activity and projections of economic performance. The Index, therefore, must be augmented by a planning and analysis process that applies the appropriate methodology in assessing future airport requirements.

Because the existing Classification Index is based upon the current situation and activity at a site, it is not an appropriate tool for evaluating emerging or forecast requirements for an airport.

The CI, must be augmented by a planning and analysis process that assesses future airport requirements.

Observation:The Airport Classification System is not an effective tool in determining individual airport runway requirements. Because it covers many other facilities, the System and related Classification Index may continue to have value for other purposes.

6.3 Northern Airport Planning

6.3.1 The Airport Role

Economic factors are the arbiters of development plans in Southern Canada and the U.S. Increasingly, as the pressures of reduced fiscal resources impose constraints on capital and operating funds, Northern airports will become subject to similar economic pressures. Airports will no longer automatically be eligible for a given standard of facility because of inclusion in a category, instead the economic case for expansion or replacement will rule.

A key consideration in the allocation of public funds for airport operation and development is the role played by the airport in the overall system. As Northern communities become increasingly responsible for airport management and operation, funding allocation decisions will involve choices between airport development and other community services. Local authorities need the tools to plan effectively with the assurance that expenditures achieve the desired objective.

As stated previously, safety of operation is the unquestioned first priority, but only rarely are airport development issues solely related to safety issues. Beyond safety considerations, therefore, the role of a particular airport in terms of its function and participation within the system establishes the starting point for the economic evaluation of development proposals. In other words, the level of public investment in an airport must be consistent both with its role and the economic merit of the development proposal.

As discussed in Section 2, the structure of the Northern air transportation system consists of a number of gateway hubs, feeding regional hubs, which in turn are connected, to community airports. From this approach, Northern airports may be classified into one of three role categories as shown in Table 6.1.

Table 6.1
GNWT Airport Categories

Categories	Airports
Gateway Hubs	• Yellowknife • Iqaluit • Rankin Inlet
Regional Hubs	• Inuvik • Norman Wells • Cambridge Bay • Resolute Bay
Community Hubs	• The remaining 45 GNWT airport sites

The part that each airport plays in this structure constitutes a logical basis on which to establish priorities and to reach decisions predicated on economic merit. While it may be argued that community airports may also be classified according to remoteness or dependency on air transportation, this is addressed by the inclusion of a factor in the evaluation methodology proposed in this section. Figure 6.1 illustrates the GNWT Airport System.

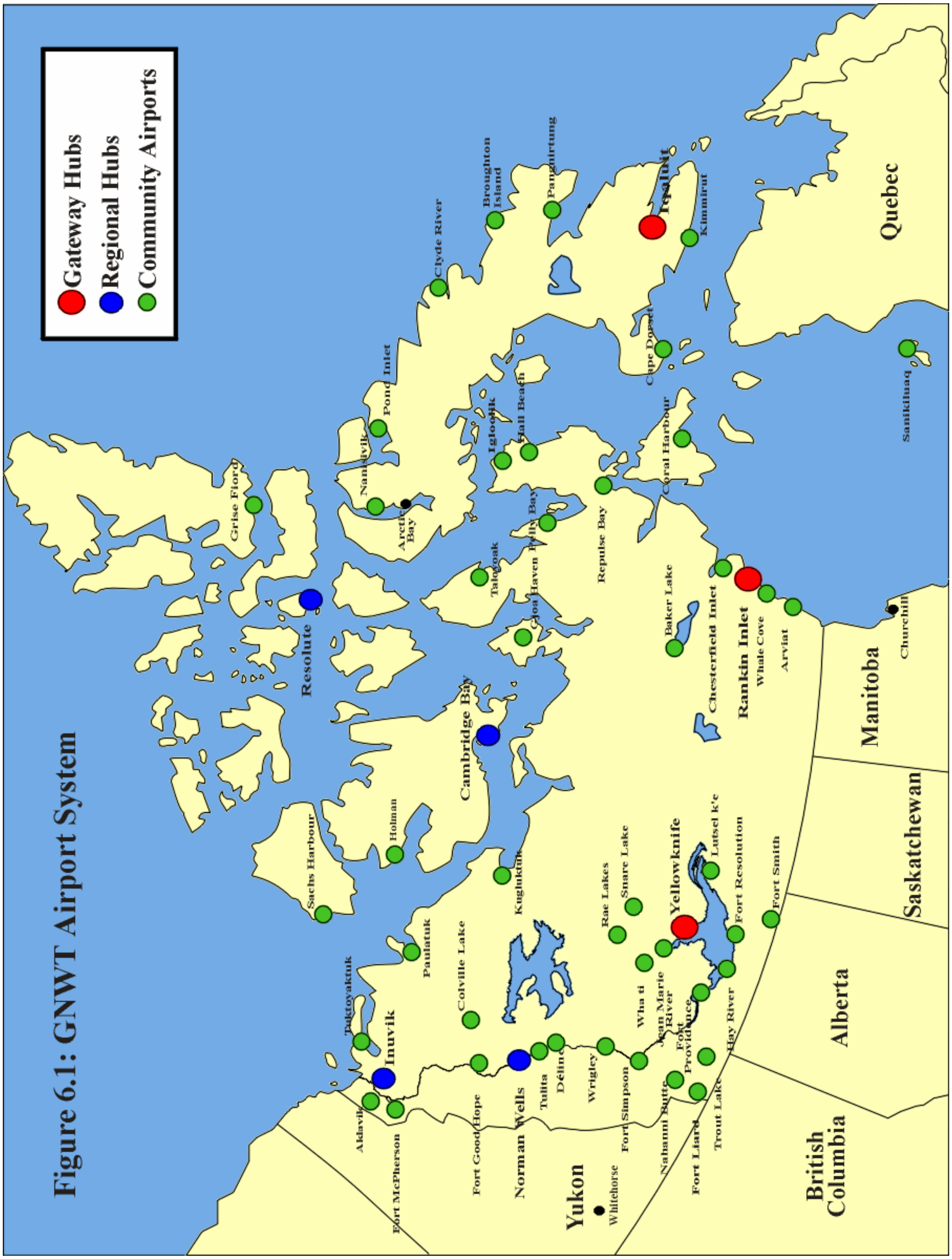


Figure 6.1: GNWT Airport System

6.3.2 Planning Approach by Airport Category

The deregulation of Northern air services has shifted the focus of Northern airport operation from a structured and somewhat standardized system approach to a more market driven system. Yet, the Northern environment will continue to be dominated by the characteristics of a sparse, far flung population heavily dependent on air travel. Within this setting, the government role is to provide an aviation environment that promotes efficient, competitive services throughout the North. To this end, it is proposed that a planning system be adopted that applies the rigor of the economic test with the unique requirements of supporting and maintaining a viable Northern air transportation system.

> The planning system must:
>
> - Make for provision of the needs of each airport, regardless of size
> - Be based on aviation forecasts
> - Determine runway requirements by comparison to the airport's "Planning Aircraft" performance

There are three key principles observed in the approach to Northern airport planning and runway requirement analysis:

- First, the planning system must make provision for the needs of each airport to be addressed regardless of size.
- Second, planning and investment decisions should be based on aviation demand forecasts and the economic case for meeting such demand.
- Third, runway requirements should be determined by comparison to "Planning Aircraft" performance.[iii]

The proposed system applies specific planning methodologies tailored to each category of airport. It also seeks to initiate planning only when and where needed. This reduces overall system planning costs by focusing on those sites that involve investment decisions.

The planning approach proposed for each category of airport is described in the following subsections.

6.3.2.1 Gateway Hub Planning Mechanism: Airport Master Plans

The complexity of operation and importance of the Gateway Airports requires the preparation of an Airport Master Plan. Updated every 5 years, the Master Plan will provide an assessment of airport capacity and development requirements based on a comprehensive set of aviation activity forecasts, including planning peak analysis. Predicated upon demand forecasts and market analysis for passengers and cargo, the appropriate Planning Aircraft

> The complexity of operation and importance of the Gateway Airports requires the preparation of an Airport Master Plan.

will be identified as the criterion for airside development. Demand /Capacity analysis based on Planning Peak Hour forecasts will drive terminal design, airside facility requirements and landside transportation planning.

6.3.2.2 Regional Hub Planning Mechanism: Airport Systems Plan

Although less complex than the Gateway Airport, the Regional Hubs require a capacity analysis of major airport subsystems. An update of this analysis is recommended to be undertaken every five years. Less detailed than the Master Plan, the Systems Plan is predicated on 10 year forecasts of aircraft movements, passenger traffic and cargo volumes, and assesses the airport's major systems capacity to meet forecast demand. It identifies a Planning Aircraft and the required airside and terminal environment to support operations.

6.3.2.3 Community Airport Planning Mechanism: Airport Planning Index

As the largest and most diverse category, the Community Airports require a simple yet effective planning process that initiates detailed site assessment when required. For this purpose, the Airport Planning Index (API) has been developed.

The API is an indicator that monitors small to medium airport operations by assessing the capacity of the Planning Aircraft to serve traffic demand. The runway length required by the Planning Aircraft for the routes served is the key runway length determinant. Recognizing the limited data available at many airports, the API only requires enplaned passenger statistics, in addition to basic aircraft movement data.

Community Airports require a simple yet effective planning process

For this purpose, the Airport Planning Index (API) has been developed.

The API is a ratio of the annual total enplaned passengers compared to the annual capacity available on a 5-day per week service schedule. The available capacity of the Planning Aircraft is reduced to take account of cargo space requirements at sites served primarily by combi aircraft and a factor is also applied to reduce seat availability if enroute stops are involved. A further adjustment, the Frequency Factor, is applied to reflect the number of round trips that a single aircraft can provide in a 10 hour "day". As the distance to the hub airport increases, the Frequency Factor ranges from 3 to 1 as a function of the time required to fly to the hub airport.

The formula for the API is as follows:

$$\textbf{API} = \frac{\textbf{Annual Enplaned Passengers}}{\textbf{PA Capacity*FF*5*51}}$$

where:

Enplaned Passengers: Annual total if known. (May be approximated by scaling up monthly data with a known seasonal factor) Dividing Enplaned and Deplaned passengers by two is an acceptable approach as annual passengers are generally directionally balanced.

PA Capacity (Planning Aircraft Capacity): The Planning Aircraft is the aircraft that carries the predominant number of passengers at the site. The seating capacity is that of the typical passenger configuration. A “Combi Factor” (CF) is applied to reduce the number of seats by 50% at airports where the Planning Aircraft operates in combi configuration.

If the airport is an enroute stop, a "Service Factor" is applied to reduce the Planning Aircraft capacity by 50% to account for seats occupied by en route passengers.

Therefore, PA Capacity = Standard seating capacity*CF*SF

For example, at airports served by combi aircraft that do not have direct service to the hub, 25% of the seating capacity will be shown as available. In the case of the HS 748 the calculation is:

PA Capacity = 48*.5*.5 = 12

FF (Frequency Factor): Obtained by comparison of flight time to Hub and the number of round trips available by the Planning Aircraft in a 10 hour day with 45 minute turn rounds. It is defined as follows:

Flight Time To Hub	***Frequency Factor***
More than 1 hr 56 min	1
1hr 01min to 1 hr 55 min	2
1hr or less	3

The service capacity is calculated over 5 days a week for 51 weeks to allow for service interruptions over the course of the year.

6.3.2.4 API Assessment Guidelines

An API of 1 indicates that 5 day-a-week service is at capacity. Given that not all passengers may travel on the planning aircraft on scheduled service, increases in the index beyond 0.5 indicate a need to monitor the site. At 0.75 or above, a requirement of change in service pattern is implicated. The response could be to increase frequency, add direct flights to the hub or upgrade to a larger aircraft.

The API provides an early indication that detailed site planning is probably necessary. This will involve consultation with users and stakeholders to confirm that an operational problem exists. If the solution may require an upgrade to facilities, options should be developed on the basis of forecasts of passenger traffic, cargo volumes and aircraft movements. The object of the analysis will be to identify the most appropriate planning aircraft to meet demand.

The API, therefore, is a tool that provides an ongoing assessment of the validity of the selected Planning Aircraft. With a modest data input requirement, the Index triggers site planning only when and where it is needed and thus conserves planning resources. It also will provide a powerful tool to airport operators, air carriers and communities in assessing airport performance and service capabilities. The API provides a simple means of assessing the impact of changes in aircraft size on the frequency of service. For example, if a community airport with an API of .35 was receiving service three days a week, any substantial increase in aircraft seating capacity would likely result in reduced weekly frequency due to economics of aircraft operation. By the same token, if more frequent service was desired, a smaller capacity aircraft would be necessary.

Table 6.2 provides a summary of the system indicators and the planning indices obtained for each of the 45 community airports in the NWT.

Table 6.2
Community Airport Planning Index

Airport	Classification	Certified	Planning Aircraft	Capacity	Cargo Factor	Service Factor	Site Capacity	Enplaned Passengers	Hub	Distance (NM)	Time	Direct Service	Frequency Factor	API
Aklavik	C	yes	B-99(C)	16	0.5	1.0	8	2,591	Inuvik	35	0:20	Y	3	0.42
Arviat	B	yes	SAAB340	35	0.5	0.5	9	3,665	Rankin	117	0:35	N	3	0.55
Baker Lake	B	yes	SAAB340	35	0.5	0.5	9	3,479	Rankin	140	0:45	N	3	0.52
Broughton Island	C	yes	HS748(C)	48	0.5	0.5	12	1,507	Iqaluit	256	1:15	N	2	0.25
Cape Dorset	C	yes	HS748(C)	48	0.5	1.0	24	1,916	Iqaluit	213	1:05	Y	2	0.16
Chesterfield Inlet	C	yes	EMB110	18	0.5	0.5	5	1,246	Rankin	49	0:15	N	3	0.36
Clyde River	C	yes	HS748(C)	48	0.5	0.5	12	1,536	Iqaluit	459	2:15	N	1	0.50
Colville Lake	D	no	Tw Otter(C)	18	0.5	0.5	5	232	Norman Wells	108	0:50	N	3	0.07
Coral Harbour	C	yes	HS748(C)	48	0.5	0.5	12	1,690	Rankin	253	1:20	N	2	0.28
Déline	C	yes	Tw Otter(C)	18	0.5	0.5	5	2,066	Norman Wells	85	0:40	N	3	0.60
Fort Good Hope	C	yes	B-99(C)	16	0.5	1.0	8	2,143	Norman Wells	78	0:40	Y	3	0.35
Fort Liard	D	yes	Caravan	9	1.0	1.0	9	1,167	Yellowknife	310	2:20	Y	1	0.51
Fort McPherson	D	yes	B-99(C)	16	0.5	1.0	8	605	Inuvik	62	0:25	Y	3	0.10
Fort Providence	D	yes	Saratoga	6	0.5	0.5	2	120	Yellowknife	108	0:50	N	3	0.10
Fort Resolution	D	yes	Tw Otter(C)	18	0.5	1.0	9	323	Yellowknife	80	0:30	Y	3	0.05
Fort Simpson	C	yes	Gulfstream (C)	35	0.5	1.0	18	4,023	Yellowknife	198	1:10	Y	2	0.45
Fort Smith	A	yes	F-28	48	1.0	1.0	48	7,814	Yellowknife	164	1:00	Y	3	0.21
Gjoa Haven	C	yes	HS748(C)	48	0.5	0.5	12	2,236	Cambridge	201	1:00	N	3	0.24
Grise Fiord	D	no	Tw Otter(C)	18	0.5	1.0	9	560	Resolute	130	1:35	Y	2	0.12
Hall Beach	B	yes	HS748(C)	48	0.5	0.5	12	1,317	Iqaluit	431	2:00	N	1	0.43
Hay River	A	yes	F-28	48	1.0	1.0	48	12,506	Yellowknife	105	0:30	Y	3	0.34
Holman	C	yes	HS748(C)	48	0.5	0.5	12	1,323	Cambridge	282	1:30	N	2	0.22
Igloolik	C	yes	HS748(C)	48	0.5	0.5	12	1,995	Iqaluit	471	2:15	N	1	0.65
Jean Marie River	D	no	Tw Otter(C)	18	0.5	0.5	5	125	Yellowknife	183	1:25	N	2	0.05
Kimmirut	C	yes	Tw Otter(C)	18	0.5	1.0	9	2,049	Iqaluit	64	0:30	Y	3	0.30
Kugluktuk	B	yes	HS748(C)	48	0.5	0.5	12	3,704	Cambridge	168	0:50	Y	3	0.40
Lutsel K'e	C	no	Caravan	9	1.0	1.0	9	1,397	Yellowknife	120	0:55	Y	3	0.20
Nahanni Butte	D	no	C-206	8	0.5	0.5	2	240	Yellowknife	279	2:05	N	1	0.47
Nanisivik	C	yes	B737(C)	110	0.5	1.0	55	2,300	Resolute	204	0:40	Y	3	0.05
Pangnirtung	B	yes	HS748(C)	48	0.5	1.0	24	3,322	Iqaluit	162	0:50	Y	3	0.18
Paulatuk	C	no	B-99(C)	16	0.5	1.0	8	690	Inuvik	216	1:05	Y	2	0.17
Pelly Bay	C	no	HS748(C)	48	0.5	0.5	12	1,308	Cambridge	337	1:40	N	2	0.21
Pond Inlet	B	yes	HS748(C)	48	0.5	0.5	12	2,752	Iqaluit	690	3:20	N	1	0.90
Rae Lakes	D	no	Caravan	9	1.0	0.5	5	751	Yellowknife	125	1:00	N	3	0.22
Repulse Bay	C	yes	HS748(C)	48	0.5	0.5	12	1,342	Rankin	273	1:20	N	2	0.22
Sachs Harbour	C	yes	B-99(C)	16	0.5	0.5	4	696	Inuvik	285	1:30	N	2	0.34
Sanikiluaq	C	yes	HS748(C)	48	0.5	0.5	12	721	Iqaluit	497	2:25	N	1	0.24
Snare Lakes	D	no	Caravan	9	1.0	0.5	5	1,600	Yellowknife	105	0:50	N	3	0.46
Taloyoak	C	yes	HS748(C)	48	0.5	0.5	12	1,975	Cambridge	276	1:20	N	2	0.32
Trout Lake	D	no	Tw Otter(C)	18	0.5	0.5	5	160	Yellowknife	278	1:30	N	2	0.07
Tuktoyaktuk	B	yes	B-99(C)	16	0.5	1.0	8	4,910	Inuvik	68	0:25	Y	3	0.80
Tulita	C	yes	Caravan	9	1.0	1.0	9	1,310	Norman Wells	45	0:25	Y	3	0.19
Wha' Ti	D	no	Caravan	9	1.0	0.5	5	1,656	Yellowknife	90	0:45	N	3	0.48
Whale Cove	C	yes	HS748(C)	48	0.5	0.5	12	1,559	Rankin	40	0:15	N	3	0.17
Wrigley	D	yes	Tw Otter(C)	18	0.5	0.5	5	1,115	Yellowknife	252	1:25	N	2	0.49

Notes:
1. Non-Stop Hub Service means service terminates and originates at hub.
2. Caravan not shown as "combi" because seating is restricted to 9 by regulation.
3. Pax statistics are for 1996 with exceptions of the following:

1991: Aklavik, Fort Providence, Grise Fiord, Nahanni Butte, Paulatuk, Sachs Harbour, Trout Lake, Wrigley. 1994: Snare Lakes.

Recommendation: That the following airport planning structure be adopted for GNWT Airports: Gateway Hub Airports: Airport Master Plan, Regional Hub Airports: Airport Systems Plan and Community Airports: Airport Planning Index

6.4 Airport Runway Projects: Typologies and Evaluation Methodologies

6.4.1 Runway Project Typologies

There are essentially three reasons for undertaking expansion or re-location of an airport. The first relates to safety issues; the second relates to socio-economic objectives; and the third relates to level of service requirements. All other reasons are sub-sets of these three. The apparent simplicity of these categories belies the complexity of reaching decisions involving investment in airport runways and associated infrastructure. Nevertheless, the selection of the appropriate option can be greatly eased by adherence to a process that carefully and rigorously subjects the proposal to appropriate tests and scrutiny. The following sections contain a proposed methodology for the evaluation of airport runway expansion/re-location proposals.

There are three reasons for undertaking airport expansion or relocation:

- Safety issues
- Socio-economic objectives
- Level of service requirements

6.4.1.1 Safety Related Projects

Airports that support scheduled services in Canada are required to be "certified" by Transport Canada. Certification implies conformance with a comprehensive set of standards that by design provide a safe operating environment. The standards vary according to the size of aircraft to be served and the weather conditions (VFR or IFR) for which the airport is equipped. In light of this, two conditions may exist: the airport meets or does not meet certification standards.

Certified Airports

If the airport is certified, it satisfies the necessary criteria and is, by definition, safe. Proposals to lengthen the airport runway or re-locate the airport are therefore not related to aviation safety, but rather to a desire to accommodate a different category of aircraft or to permit an increase in aircraft operating weight. In either case, the proposal is based on level of service requirements and not safety. Pilots who attempt to operate from or to runways that have insufficient length for the aircraft and conditions are in violation of Canadian Aviation Regulations. The purpose of the regulations is to protect the travelling public by providing appropriate margins of operating safety.

Non Certified Airports

Airports (technically "aerodromes") that fail to meet certification standards provide complex challenges to operator and regulator alike. Nowhere more so than in the North. Here the limited availability of land at many sites, often combined with a scarcity of building material, restricts alternatives and options. Yet, the community is frequently totally dependent on the airport for transportation. Resolution requires the attainment of a consistent level of safety that is acceptable to Transport Canada through conduct of an aeronautical study. Solutions involve complex assessments by experts from the following agencies and individuals:

- Transport Canada – Aerodrome Safety Branch
- Transport Canada – Business and Commercial Aviation
- The airport operator
- NAV CANADA specialists
- Air Carrier representatives
- Airport Engineers and planners

In total, this group constitutes a site planning team and every effort should be made to convene meetings on site. To assist the planning effort, an aircraft movement forecast should be prepared that includes an estimate of the optimum size of aircraft consistent with site demand. The alternatives determined by the group may include:

- Certification by the application of operational restrictions, such as to aircraft type and weather conditions; imposition of special procedures; and requirements for additional training and crew qualifications.
- Physical changes to the airport and environs including marking and lighting requirements.

In making a determination, the assessment team will no doubt take into consideration the operational record of the airport concerned. Several uncertified airports have a long record of successful, safe operation. Others, however, may pose tangible threats to safety. In the extreme case, certification may not be possible. This situation would clearly involve several elements of public policy; a methodology for assessing such situations is discussed later in this section.

6.4.1.2 Socio-Economic Related Projects

If the project is related to an economic development project, or involves an airport re-location intended to achieve social policy objectives, the project cannot be assessed by applying standard aviation planning methodology. Such projects encompass a very broad range of issues that go far beyond the aviation arena, into public policy and economic strategy. As a generalization, however, projects related to other than aviation objectives should not burden aviation funding. An appropriate methodology for assessing such projects is provided by the "Multiple Account Evaluation

Guidelines"[iv] which establishes a framework for integrated planning to achieve societal goals. A copy of these guidelines is provided in Appendix 11.

Multiple Account Analysis provides the framework for the consideration of a broad set of factors and lends itself to the inclusion of multi-modal and multi-sector factors which provide an expanded set of alternatives than is normally available from aviation planning analysis.

Recommendation: That Multiple Account Analysis methodology be used to evaluate airport expansion proposals related to socio-economic initiatives.

6.4.1.3 Level of Service Related Projects

The shift to a market driven air service structure in the North was marked by the July 1996 legislation that removed the "designated area" provision and placed entry requirements for air services on the same basis throughout Canada. This regulatory relief opens the door for increased competition, while the amended Air Transport Regulations together with the Canadian Aviation Regulations are designed to provide economic performance and safety standards for the protection of the travelling public.

For Northern airports, the most significant change may be evident in a trend to more frequent changes in the carriers and types of aircraft operating air services. Given the unique operating conditions in the North, however, and the sparse populations served over long routes, the decisions to make major investments in these markets face challenging economic factors. By the same token, airport development proposals seeking improved level of service and economic performance from air carriers must recognize and reflect the prevailing and forecast market conditions. The proposal should demonstrate a sound business case based on realistic assumptions of economic performance. Failure to adhere to this principle can only result in investments that fail to achieve the desired objective. Level of service related expansion proposals will thus require support through the planning process recommended earlier in section 6.3, i.e.:

Hub Airports - Recommendation from an approved Airport Master Plan or Airport Systems Plan.

Community Airports: - Recommendation from an approved Site Plan completed in response to a high API.

6.4.2 Runway Project Evaluation Methodologies

Methodologies for evaluating development projects are provided below by airport category.

6.4.2.1 Gateway Hub Runway Project Evaluation

As recommended above, Gateway Hub development should be guided by an Airport Master Plan. This greatly simplifies project evaluation by providing a benchmark against which to assess the proposal. The project will fit into one of two cases: consistent or not consistent with the Master Plan. Review procedures are adjusted accordingly as discussed below.

Project Consistent with Airport Master Plan

If the proposal is consistent with the Master Plan it will already have been approved in principle. The review process is therefore focused on ensuring that the requirement, timing, benefits and costs support implementation. The key criteria for approval are that the project is necessary in the context of the airport's hub role and that it is a cost-effective solution. The following evaluation process represents a typical approach:

- Assess the requirement and timing of the project against current and forecast aircraft movement and passenger forecasts.
- Review the consistency of the proposal with the overall air service route structure. Ripple effects on other airports should also be considered.
- Review the business plan. Costs and benefits should be detailed and present value analysis completed.
- Review alternatives. The range of options will obviously vary from site to site, but considerations should include: (1) improving the surface of the runway rather than extending; (2) providing clearway and/or stopway; and (3) improving maintenance rather than providing additional length for contaminated runway operations.

Project Not Contained in Airport Master Plan

Provided that the hub Airport Master Plans are current, the occurrence of major runway project proposals being submitted that are not addressed in the plan will be rare. If the proposal is directly related to the airport's capability to serve as a hub, the project should be addressed using a similar process as for a Master Plan approved project, but with a stronger focus on the rationale and economic justification. Broad consultation will be necessary.

6.4.2.2 Regional Hub Runway Project Evaluation

The same considerations that apply to the Gateways should be applied to Regional Hubs. Since it is recommended that these sites have Airport Systems Plans, forecasts will be required to support the evaluation process. In some cases, however, more detailed analysis may be required.

6.4.2.3 Community Airport Runway Project Evaluation

Community airport project proposals for improved or lengthened runways will belong in one of two categories: API activated or from an independent source such as an economic development proposal. As recommended previously, economic development proposals should be evaluated through Multiple Account Analysis (see Appendix 11). API activated projects are evaluated as follows:

1. Review statistics: confirm current Planning Aircraft capacity.
2. Calculate API.
3. If API is above 0.75, consult with community and carrier(s) to confirm problem.
4. Increase capacity to bring the API to an acceptable level (below 0.75). This may be achieved by (see example below):
    a. Increasing weekly frequencies with same PA;
    b. Increasing PA capacity by re-configuration or changing to non-stop service;
    c. Using larger PA; or
    d. Combination of above.
5. Consult with the carrier(s) and community to determine the most appropriate response.
6. If a change in Planning Aircraft is required confirm that sufficient runway facilities exist for desired option.
7. If a runway extension is implicated as a requirement, conduct a detailed site expansion analysis that includes passenger/cargo/aircraft movement forecast to justify such extension.

<u>API Assessment Calculation</u>

Although an API is only an indicator of approaching Planning Aircraft capacity, it may also be used to assess the significance of the increase in capacity required and to identify potential solutions. An example of this is provided in Box 6.1.

Box 6.1 – API Assessment

A service problem has been observed at Airport A, which obtains an API of 1.0 under the following conditions:

- Annual Enplaned Passengers: 3100
- Planning (PA) Aircraft Capacity: 12 (48 seat aircraft reduced by 50% for combi configuration (CF) and by 50% for an en route stop (SF))
- Flying time to hub: 2 hours 15 minutes
- Frequency Factor (FF): 1

where

$$\textbf{API (Airport A)} = \frac{\textbf{Annual Enplaned Passengers}}{\textbf{PA Capacity*FF*5*51}} = \frac{\textbf{3,100}}{\textbf{(12*1*5*51)}} = \textbf{1.0}$$

Given that the existing weekly total seat capacity is 60 (Pa Capacity*5), the increase in weekly capacity required to reduce the API to 0.75 may be calculated as follows.

$$\textbf{Airport (Airport A)} = \frac{\textbf{3,100}}{\textbf{New Weekly Capacity*1*51}} = \textbf{0.75}$$

then

$$\textbf{New Weekly Capacity (Airport A)} = \frac{\textbf{3,100}}{\textbf{0.75*1*51}} = \textbf{81 Seats}$$

The additional weekly capacity required to decrease the API is therefore the difference between the existing weekly capacity and the new weekly capacity. In this case, the additional weekly capacity required for Airport A is 21 seats.

Under the assumptions of this example, the service problem at Airport A can be addressed by:

- Use the same Planning Aircraft but increase weekly frequency by two*: 12 seats*2 = 24 additional seats per week.*
- Increasing PA capacity to 17 seats by reconfiguring a combi or using a larger aircraft: *5 seats*5 = 25 additional seats per week.*
- A further option would be to add one direct flight by the combi aircraft to gain a weekly seat increase of the full 24-seat capacity.

The foregoing example is provided to illustrate the application of the API to solving level of service issues. In practice, solutions are more complex as they involve other factors such as route implications and aircraft scheduling issues that require detailed examination with the air carriers providing service. Furthermore, aircraft upgrade and airport expansion decisions would require support by site demand forecasts.

6.5 Summary

The critical role played by air transportation in the Arctic presents a challenging set of conditions for airport planning. For many communities the airport may be, for all or part of the year, the only transportation link. At the same time, the limited resources available for operation of the system make it increasingly important that infrastructure investment decisions be based on sound economic considerations.

The GNWT Airport Classification System, augmented by a Classification Index, derives from a Federal program standard set in 1974. The System is no longer in tune with current requirements and provides little flexibility in matching runway requirements to site specifics. In particular, it does not address the demand driven requirements of the airport.

To address these deficiencies, a revised approach to Northern airport planning is proposed. The system establishes three airport categories each with a planning methodology suited to the airport role:

- Gateway Hub - Airport Master Plan
- Regional Hub - Airport Systems Plan
- Community Airport - Airport Planning index

Seven of the 52 GNWT airports are identified as hubs. The development of these airports is guided by the preparation of comprehensive plans predicated on forecast aircraft movements and passenger and cargo volumes. Detailed system demand/capacity analysis and designation of a Critical or Planning Aircraft are used to identify future requirements.

Because of their vital role, Community Airports also require site plans. Due to the cost and work involved however, these plans should only be prepared when required. The Airport Planning Index has been developed. The API monitors the site by verifying that the capacity of the selected Planning Aircraft is adequate for demand. APIs over 0.75 suggest action will be required to augment capacity. The API takes into account the following:

- Cargo space allocations on "Combi" aircraft.
- En route stop capacity constraints
- Distance/time to a Hub airport

There are three major reasons for undertaking airport expansion or relocation:

1. Safety issues
2. Socio-economic objectives
3. Level of service requirements

The evaluation of projects seeking runway expansion or airport relocation to achieve runway expansion is undertaken by the following methodologies:

Safety Related Projects.

Certified Airports – The airport is by definition safe and the proposal is therefore related to other objectives.

Non Certified Airports – In conjunction with Transport Canada undertake a technical site analysis with a multidisciplinary team. The objective is to achieve a consistent level of safety that is acceptable to Transport Canada through the application of special operating procedures and site modifications.

Socio-economic related Projects

Undertake a detailed analysis, apply Multiple Account Analysis methodology. Multiple Account evaluation is a technique which broadens the scope of analysis to identify costs and benefits to the community at large. It is particularly appropriate for transportation projects which have societal goals involving several agencies where multi-modal and other alternative program objectives must be considered and integrated.

Level of Service Related Projects

Evaluation based on:

Hub Airports – Recommendation from an approved Airport Master Plan or Airport Systems Plan

Community Airports – Recommendation from an approved Site Plan completed in response to a high API.

[1] The Planning Aircraft for hub airports is synonymous with “Critical Aircraft.” For Community Airports, it is the aircraft type that carriers the predominant number of passengers at a site.

Province of British Columbia, Crown Corporations Secretariat, “Multiple Account Evaluation Guidelines”, Victoria, 1993.

7. Runway Requirements Analysis

7.1 Methodology

Section 5 outlined the anticipated changes to the air service structure in the NWT over the next 20 years and proposed a network of Gateway Hubs, Regional Hubs and Community Airports to serve the system during this period. In Section 6, a planning approach was proposed for each airport category. At Hub Airports, the approach applies standard demand/capacity analysis methodology to assess airside requirements and uses Critical Aircraft for runway analysis. At Community Airports, an Airport Planning Index is introduced to monitor demand/capacity and, under certain conditions, to trigger site assessments.

In this section, these methodologies are applied. Prior to applying these methodologies, however, designated Critical Aircraft have been reviewed at each Hub Airport, and Planning Aircraft have been identified for each Community Airport. For planning purposes, Critical Aircraft at Hub Airports should be reviewed every five years. At Community Airports, the selection of the Planning Aircraft is monitored by the Airport Planning Index, with redefinition of the Planning Aircraft as one possible response to a persistently high API. Note that the API is not intended to assess safety conditions at Community Airports: Transport Canada oversees aviation safety in Canada through regulation and certification processes. The methodology assumes, therefore, that if Transport Canada certifies an airport, it is considered to be safe for commercial operations.

Using this methodology, the following subsections assess GNWT runway requirements to the planning horizon according to runway capacity, airport role, and the availability of aviation support systems.

Runway Assessment Methodology:

- Applies Critical Aircraft requirement at Hub Airports
- Applies present and future Planning Aircraft criteria at Community Airports
- Assumes that if an airport is certified it is safe for commercial operations.

7.2. Runway Capacity

A broad review of current and anticipated aircraft movements across the GNWT system indicates that, on an annual movements basis, all airports have sufficient runway capacity to meet forecast

All GNWT airports have sufficient runway capacity to meet forecast demand for the next 20 years demand for the next 20 years. Detailed hourly analysis would require generation of peak hour forecasts, which is beyond the scope of this report. It is considered highly unlikely, however, that any site would experience more than occasional delays of short duration. These delays would occur predominantly under IFR conditions.

7.3 Runway Length Assessment

The required length of runway at all GNWT airports has been assessed using the methodology outlined in Section 6. Runway width requirements and associated standards are implicit in the selection of the Critical/Planning Aircraft in accordance with Transport Canada standards.

7.3.1 Hub Airport Analysis

Table 7.1 summarizes the results of a comparison of current and forecast requirements for runways at the seven Hub Airports. The analysis takes into consideration the Critical Aircraft performance operating on the route segments served. Two Hubs have potential deficiencies over the next ten years: Cambridge Bay and Resolute Bay.

Table 7.
Hub Airport Runway Assessment

Airport	Hub Role	Total Aircraft Movements		Critical Aircraft	Existing Runway	Assessment	Remarks
		1996	*2017*				
Yellowknife	Gateway	62,881	70,500	B737	7500 x 150 paved	No restrictions	Nil
Iqaluit	Gateway	18,150	23,500	B727	9000 x 200 paved	No restrictions	Diversion airport for trans-polar/Atlantic routes.
Rankin Inlet	Gateway	9,452	12,100	B737	6000 x 150 paved	Meets route requirements	
Norman Wells	Regional	14,924	18,500	B737	6000 x 150 paved	Meets route requirements	Nil
Inuvik	Regional	14,268	18,000	B737	6000 x 150 paved	Meets route requirements	Nil
Cambridge	Regional	4,804	6,400	B737	5000 x 150 gravel	Meets route requirements	Gravel surface restricts use by later B737 versions. Length marginal.
Resolute Bay	Regional	5,855	4,900	B737	6500 x 200 gravel	Meets route requirements	Gravel surface restricts use by later B737 versions.

Notes: "Meets Route requirements" indicates runway length will not permit maximum weight take off under all conditions but that payload is acceptable for the route structure requirements.

Cambridge Bay: The gravel surface and marginal length of this runway inhibits its use by B737-200 fan-engined replacements. This will prevent "southern fleet" aircraft from using the airport and thus limit competition. As discussed in Section 5, Cambridge Bay activity is expected to grow throughout the period as a result of its designation as a Nunavut Government regional office.

Site Recommendation: Pave within 10 years. Extend runway to 6,000 feet. 5,500 feet may be acceptable based on current B737-300 data. (See Appendix 12 for Reid Crowther engineering feasibility assessment).

Resolute Bay: The gravel surface inhibits use by B737-200 fan-engined replacements and will limit competition on the route to gravel capable aircraft.

Site Recommendation: Due to the uncertain future of jet service if the Little Cornwallis mine closes, no decision should be taken at this time. (See Section 5) Review in 5 years.

7.3.2 Community Airport Assessment

Table 7.2 summarizes the results of the Community Airport assessment. Of the 45 airports, only two, Pangnirtung and Repulse Bay, impose payload limits on the current Planning Aircraft. Both Grise Fiord and Kimmirut, however, are unable to accept larger Planning Aircraft and require special operating procedures to achieve full payload.

The analysis addresses sites with high API values and also those without Transport Canada certification.

HIGH API SITES

Table 7.2 contains the current Airport Planning Indexes as calculated from the latest available data. Two airports exhibit APIs over 0.75: Pond Inlet and Tuktoyaktuk.

Pond Inlet (API 0.9): Pond Inlet is expected to experience increased passenger activity as a result of its designation as a Nunavut Regional Government Auxiliary office. As a result, additional service to Iqaluit and Igloolik is considered probable.

Site Recommendation: Monitor, update data, consult with community and carrier. Note that the addition of one direct flight to Iqaluit (24 seats) would reduce the API to about 0.65.

Tuktoyaktuk (API 0.8): No rapid growth anticipated. Current use of B99's limits capacity.

Site Recommendation: Current Planning Aircraft capacity could be increased. Site would not require runway extension to accommodate larger Planning Aircraft.

Payload Restriction for Current and Future Planning Aircraft.

Pangnirtung: The 2,900 feet runway imposes a takeoff and landing penalty on the HS 748 Planning Aircraft. To satisfy current and future requirements a 600 foot extension to 3,500 feet is required. This site has a complex set of limitations and constraints relating to terrain, land availability and community planning. In addition, the terrain results in a high instrument approach minimum descent altitude. Detailed site and alternative analysis is required to assess options and provide the basis for a long term plan.

Site Recommendation: Conduct a technical site evaluation and assess options using Multiple Account Analysis.

Payload Restriction for Current Planning Aircraft

Repulse Bay: The 3,400 foot runway does not permit the HS 748 to land at maximum landing weight – 3,500 feet is required. The non-availability of fuel at this site requires maximum weight landings to achieve full payload.

Site Recommendation: Extend runway to provide 3,500 foot Landing Distance Available.

Table 7.2

Community Airport Runway Assessment

Airport	Certified	Length (ft)	Runway Surface	Current Planning Aircraft	Future Planning Aircraft	Current PA Restrictions	Future PA Restrictions	API	Recommendation
Aklavik	Yes	3,000'	gravel	B-99(C)	B-1900D	Nil	MWL(2). Max payload to Hub.	0.42	
Arctic Bay(1)	No	1,500'	gravel	Nil	Nil	N/A	N/A	N/A	N/A
Arviat	Yes	4,000'	gravel	SAAB340	DHC 8-200	Nil	Nil	0.55	
Baker Lake	Yes	4,200'	gravel	SAAB340	DHC 8-200	Nil	Nil	0.52	
Broughton Island	Yes	3,475'	gravel	HS748(C)	DHC 8-200	MWL(2). Max payload to hub.	MWL(2). Max payload to hub.	0.25	
Cape Dorset	Yes	4,000'	gravel	HS748(C)	ATR-42	Nil	Nil	0.16	
Chesterfield Inlet	Yes	3,600'	gravel	EMB-110	DHC 8-200	MWL(2). Max payload to hub.	Nil	0.36	
Clyde River	Yes	3,500'	gravel	HS748(C)	DHC 8-200	MWL(2). Max payload to en route fuel stop.	MWL(2). Max payload to next fuel stop.	0.50	
Colville Lake	No	2,700'	gravel	Tw Otter(C)	Tw Otter	Nil	Nil	0.07	Scheduled service. Not Certified. Site evaluation.
Coral Harbour	Yes	5,000'	gravel	HS748(C)	DHC 8-200	Nil	Nil	0.28	
Déline	Yes	2,500'	gravel	Tw Otter(C)	Grand Caravan	Nil to Hub with 8 pax or less.	Nil	0.60	
Fort Good Hope	Yes	3,000'	gravel	B-99(C)	Grand Caravan	Nil to Hub with 8 pax or less.	Nil	0.35	
Fort Liard	Yes	3,000'	gravel	Caravan	Tw Otter	Nil	Nil	0.51	
Fort McPherson	Yes	3,500'	gravel	B-99(C)	B-1900D	Nil	Nil	0.10	
Fort Providence	Yes	3,000'	gravel	Saratoga	Grand Caravan	Nil	Nil	0.10	
Fort Resolution	Yes	4,150'	gravel	Tw Otter(C)	Grand Caravan	Nil	Nil	0.05	
Fort Simpson	Yes	6,000'	paved	Gulfstream(C)	DHC 8-200	Nil	Nil	0.45	
Fort Smith	Yes	6,000'	paved	F-28	RJ	Nil	Nil	0.21	
Gjoa Haven	Yes	4,400'	gravel	HS748(C)	DHC 8-200	Nil	Nil	0.24	
Grise Fiord	No	1,950'	gravel	Tw Otter(C)	Tw Otter	STOL operation required for max load.	STOL operation required for max load.	0.12	Scheduled service. Not Certified. Site evaluation.
Hall Beach	Yes	5,200'	gravel	HS748(C)	ATR-42	Nil	Nil	0.43	
Hay River	Yes	6,000'	paved	F-28	RJ	Nil	Nil	0.34	
Holman	Yes	4,300'	gravel	HS748(C)	ATR-42	Nil	Nil	0.22	
Igloolik	Yes	3,800'	gravel	HS748(C)	ATR-42	Nil	Nil	0.65	
Jean Marie River	No	2,500'	gravel	Tw Otter(C)	Grand Caravan	Nil	Nil	0.05	Not certified. Site evaluation.
Kimmirut	Yes	1,900'	gravel	Tw Otter(C)	Tw Otter	STOL operation required for max load.	STOL operation required for max load.	0.30	
Kugluktuk	Yes	5,500'	gravel	HS748(C)	DHC 8-200	Nil	Nil	0.40	
Lutsel K'e	No	3,000'	gravel	Caravan	Grand Caravan	Nil	Nil	0.20	Scheduled service. Certification pending.
Nahanni Butte	No	2,500'	gravel	C-206	Grand Caravan	Nil	Nil	0.47	Not certified. Site evaluation.
Nanisivik	Yes	6,400'	gravel	B737(C)	B737	Nil	Nil	0.05	
Pangnirtung	Yes	2,900'	gravel	HS748(C)	ATR-42	MWL(2). Payload reduction.	MWL(2). 2400lb payload reduction.	0.18	Site Evaluation
Paulatuk	No	4,000'	gravel	B-99(C)	DHC 8-200	Nil	Nil	0.17	Scheduled service. Certification pending.
Pelly Bay	No	5,000'	gravel	HS748(C)	DHC 8-200	Nil	Nil	0.21	Scheduled service. Certification pending.
Pond Inlet	Yes	4,000'	gravel	HS748(C)	ATR-42	Nil	Nil	0.90	
Rae Lakes	No	3,000'	gravel	Caravan	Grand Caravan	Nil	Nil	0.22	Scheduled service. Certification pending.
Repulse Bay	Yes	3,400'	gravel	HS748(C)	DHC 8-200	MWL(2). Take off and Landing	MWL(2). No Payload restriction.	0.22	100' extension required for PA landing distance.
Sachs Harbour	Yes	4,000'	gravel	B-99(C)	B-1900D	Nil	Nil	0.34	
Sanikiluaq	Yes	3,800'	gravel	HS748(C)	ATR-42	Nil	Nil	0.24	
Snare Lake	No	3,000'	gravel	Caravan	Grand Caravan	Nil	Nil	0.46	Scheduled service. Certification pending.
Taloyoak	Yes	3,610'	gravel	HS748(C)	DHC 8-200	Nil	Nil	0.32	
Trout Lake	No	2,500'	gravel	Tw Otter(C)	Grand Caravan	Nil	Nil	0.07	Not certified. Site evaluation.
Tuktoyaktuk	Yes	5,000'	gravel	B-99(C)	B-1900D	Nil	Nil	0.80	
Tulita	Yes	3,000'	gravel	Caravan	Grand Caravan	Nil	Nil	0.19	
Wha'Ti	No	3,000'	gravel	Caravan	Grand Caravan	Nil	Nil	0.48	Scheduled service. Certification pending.
Whale Cove	Yes	4,000'	gravel	HS748(C)	DHC 8-200	Nil	Nil	0.17	
Wrigley	Yes	3,500'	gravel	Tw Otter(C)	DHC 8-100	Nil	Nil	0.49	

(1) Arctic Bay is not a GNWT-operated Airport. Listed for information purposes only.
(2) MWL = Maximum Weight Limited at ISA standard conditions.

Operating Restrictions to Current Planning Aircraft

The following two airports, both with runways of less than 2,000 feet in length, require special procedures to permit max payload operations.

Grise Fiord: The DHC-6 Twin Otter Planning Aircraft requires 2,500 feet of runway under CARs standards. When operated in Short Take-Off and Landing (STOL) mode using Transport Canada approved procedures and qualified crews, full payload can be achieved on the existing 1,950 foot runway. Future Planning Aircraft is the Twin Otter. The API is 0.12

Site Recommendation: Twin Otter satisfies forecast Planning Aircraft requirements. See discussion below under Non Certified Airports.

Kimmirut: The DHC-6 Twin Otter Planning Aircraft requires 2,500 feet of runway under CARs standards. When operated in Short Take-Off and Landing (STOL) mode using Transport Canada approved procedures and qualified crews, full payload can be achieved on the existing 1,900 foot runway. Future Planning Aircraft is the Twin Otter. The Cessna Grand Caravan could also operate from this site. The API is 0.30.

The airport is certified and hence deemed safe, although there are five deviations from standards. The airport is situated in rough terrain with limited land available for expansion in any direction. A recently completed draft Airport Development Plan (February, 1998) concluded that the Twin Otter currently operates without payload penalty and will satisfy demand over the 18 year horizon of the plan.

Site Recommendation: The site is certified, albeit with deviations noted by Transport Canada, and the runway meets current and future Planning Aircraft requirements. Since local land use planning issues appear to be a key driver in considering relocation, the use of Multiple Account Analysis is recommended in the assessment of alternative sites and other accessibility/transportation options.

Non Certified Airports

Under the provisions of the CARs, airports serving scheduled service are required to be certified. Of the eleven non-certified airports owned and operated by the GNWT, eight support scheduled passenger operations. Of these, six airports are at an advanced stage of the certification process, with completion imminent at the time of writing. At the two remaining airports, certification procedures must be undertaken. These airports are:

- Colville Lake
- Grise Fiord

Because all airports are now candidates for scheduled service in the NWT, it is recommended that the remaining non-certified airports be evaluated for certification. The sites are:

- Jean Marie River
- Nahanni Butte
- Trout Lake

As discussed earlier in Section 6, airport sites that do not conform to all certification standards and criteria should be the subject of a technical analysis. As the safety regulator, Transport Canada undertakes an aeronautical study to determine if equivalent levels of safety can be achieved. This requirement forms the base for the establishment of a team of experts to approach the problems from their respective disciplines with the objective of converging requirements into an overall operational plan and providing recommendations for resolution.

At the time of writing, Transport Canada is undertaking a review of Aerodrome Standards (TP 312E) which will be re-issued in a new CARs format. It is recommended that the GNWT consult with Transport Canada to obtain recognition for the special operating factors associated with northern airport operations.

Recommendation : That the GNWT consult with Transport Canada to obtain recognition and consideration for the special operating factors associated with Northern airport operations

7.3.3 Runway Assessment Summary.

Application of the assessment methodology indicates that 50 of the 52 GNWT airports (96%) support operation of the current Critical/Planning aircraft without payload restrictions. Nine community airports have some form of constraint due to runway length which reduces to seven with the introduction of replacement aircraft. Of the two airports with payload restrictions, that at Repulse Bay is minor, while the Pangnirtung case is complex and challenging.

Runway Assessment

96% of GNWT airports support operations by the Critical/Planning aircraft without payload restriction.

7.4 Aviation Support System

In addition to airport runways, there are numerous services that affect the safety, reliability and efficiency of the aviation system. Although these services do not directly relate to runway facilities, those of particular relevance to airport and air carrier operations – air navigation and airport services – are discussed below. Note that where these factors impact directly upon aircraft performance and runway operations, general recommendations are made; otherwise, only "observations" are provided.

7.4.1 Air Navigation Services

Navigation aids and communications are vital components of the northern operating environment. Global Positioning Systems (GPS) have added a new and important capability to navigate without ground based aids. At present, the instrument approach procedures for 8 GNWT airports are listed in the Canada Air Pilot for GPS use by appropriately equipped aircraft. In the future, "stand-alone" instrument approaches to airports without ground based aids is also feasible. This will open more airports to IFR operations. It is essential, however, that this capability be matched by the availability of communications and weather information.

Although air navigation services was not the main focus of this study, consultation with air carriers revealed substantial concerns with the level of service in the area of weather reporting and communications. While air carriers are not opposed to the introduction of AWOS technology to augment the existing reporting structure, this should not be at the expense of existing human observing programs until such time as AWOS technical problems are solved. AWOS is recognized as having potential to significantly expand weather reporting in remote areas.

Observation: Communications are not available or are reported as being unreliable at some airports.

Observation: Many air operators indicated concern with the hours of operation and coverage of weather reports. Human observations are preferred to automatic stations, although automatic observations are recognized as providing valuable coverage outside of regular airport operating hours.

Observation: 36 of the 52 GNWT airports have published instrument procedures in the Canada Air Pilot. At least three others appear eligible for inclusion. They are: Chesterfield Inlet, Igloolik, and Whale Cove.

7.4.2 Airport Services

The accessibility of an airport is related to the services and maintenance provided at the site. While many facilities, such as navigation aids and runway lights, may be remotely or pilot-operated and monitored, site service requirements can encourage successful operations, particularly during conditions of darkness and poor weather.

Runway Condition Reports

The benefits associated with GPS approaches will increase the usability of airports by permitting operations in lower weather conditions than is now possible. Since pilots are required to verify that the runway is clear of obstacles prior to landing, IFR operations levy a requirement for runway condition reports. Unless the airport is staffed to provide such reports, the potential benefits of lower approach minima with GPS will be negated.

In addition to IFR requirements, there is a need to provide runway condition reports at all airports during periods of darkness.

Recommendation: An analysis should be conducted of staffing and communication requirements to provide runway condition reports and airport advisories.

Runway Maintenance

It is anticipated that a Canadian Aviation Regulation with respect to contaminated runway operations will be introduced in the near future. The increased runway required to operate some types of aircraft under such conditions will clearly exceed that available at many locations. Accordingly, the appropriate and more economical response is to improve maintenance to remove the contamination from both paved and gravel rather than extend runways.

Recommendation: Establish enhanced runway condition monitoring and maintenance procedures to reduce, to the extent possible, contaminants that may interfere with aircraft operations.

Fuel Availability

The availability of aviation fuel can have a profound influence on runway requirements by avoiding the need to carry additional fuel for the next leg of the flight. The additional weight increases the take-off distance at the point of departure and extends the landing distance required. Some GNWT

airports either do not have appropriate storage facilities or carry only "P50" (Arctic diesel) which is not sanctioned for use in aircraft. Examples of airports without adequate fuel facilities include Hay River and Repulse Bay.

Recommendation: That the GNWT conduct a joint study with the northern air transportation industry to assess requirements and evaluate options to establish appropriate fuelling facilities.

7.5 Summary

Application of the assessment methodology indicates that 50 of the 52 GNWT airports (96%) support operation of the current Critical/Planning aircraft without payload restrictions. Nine community Airports have some form of constraint due to runway length which reduces to seven with the introduction of replacement aircraft.

With few exceptions, therefore, runway facilities at GNWT airports meet the requirements of both current aircraft and future replacements. To support the needs of the northern air service system, however, specific measures are required at certain sites. These sites and the measures required are as follows:

Cambridge Bay: Extend runway to 6,000 feet (5,500 feet may be acceptable); pave within 10 years to allow fan-engined jet aircraft to operate.

Pangnirtung: Runway length required 3,500 feet. Conduct a technical evaluation to address site limitations and constraint issues and assess options using Multiple Account Analysis.

Repulse Bay: Extend runway to 3,500 feet.

Colville Lake: Not certified -conduct site evaluation.

Grise Fiord: Not certified - conduct a site evaluation.

Furthermore, facility and operational safety should be confirmed at all remaining non-certified airports, regardless of scheduled service status. These sites are :

- Jean Marie River
- Nahanni Butte
- Trout Lake

8. Summary of Recommendations and Observations

8.1 Observations

Observation: The improved performance associated with replacement turboprop aircraft such as the DHC-8-200 and the ATR 42-300 will reduce runway length requirements compared to contemporary aircraft.

Observation: The Airport Classification System is not an effective tool in determining individual airport runway requirements. Because it covers many other facilities, the System and related Classification Index may continue to have value for other purposes.

Observation: Communications are not available or are reported as being unreliable at some airports.

Observation: Many air operators indicated concern with the hours of operation and coverage of weather reports. Human observations are preferred to automatic stations, although automatic observations are recognized as providing valuable coverage outside of regular airport operating hours.

Observation: 36 of the 52 GNWT airports have published instrument procedures in the Canada Air Pilot. At least three others appear eligible for inclusion, they are: Chesterfield Inlet, Igloolik, and Whale Cove.

8.2 Recommendations

Recommendation: That the following airport planning structure be adopted for GNWT Airports:

- Gateway Hub Airports: Airport Master Plan
- Regional Hub Airports: Airport Systems Plan
- Community Airports: Airport Planning Index

Recommendation: That Multiple Account Analysis methodology be used to evaluate airport expansion proposals related to socio-economic initiatives.

Recommendation: That the GNWT undertake a joint analysis with the Nunavut Government to assess options for operational and administrative management of medevac operations.

Recommendation: That the standards for air medevac carriers be expanded to contain minimum performance requirements for each airport in the area covered by the contract.

Recommendation: That the GNWT consult with Transport Canada to obtain recognition and consideration for the special operating factors associated with northern airport operations.

Recommendation: An analysis should be conducted of staffing and communication requirements to provide runway condition reports and airport advisories.

Recommendation: Establish enhanced runway condition monitoring and maintenance procedures to reduce, to the extent possible, contaminants that may interfere with aircraft operations.

Recommendation: That the GNWT conduct a joint study with the northern air transportation industry to assess requirements and evaluate options to establish appropriate fuelling facilities.