Afghanistan Transport Sector Review

Civil Aviation Sector

Report on Airport Developement including investment plan for airports

Annex to Overview

Action Plan: Civil Aviation

Abbreviations and Acronyms

AACA	Afghan Assistance Coordination Authority
AFTN	Aeronautical Fixed Telecommunications Network
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Service
ANC	Air Navigation Charge
ANP	Air Navigation Plan
ATC	Air Traffic Control
ATS	Air Traffic Services
CATC	Civil Aviation Training College
CNS/ATM	Communications, Navigation and Surveillance/ Air Traffic Management
DME	Distance Measuring Equipment
DVOR	Doppler VOR
EG	Engine-Generator
FAA	Federal Aviation Authority
GLONASS	Global Navigation Satellite System (Russian Federation)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HF	High Frequency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
ISAF	International Security Assistance Force
IWI	Illuminated Wind Indicator
Jet Fuel/Jet A1	Aviation turbine fuel
MCAT	Ministry of Civil Aviation and Tourism
MLS	Microwave Landing System
MPW	Ministry of Public Works
MTOW	Maximum Takeoff Weight

NDB	Non Directional Beacon
NGO	Non Government Organisation
NOTAM	Notice to Airmen
NPA	Non-Precision Approach
PAPI	Precision Approach Path Indicator
REIL	Runway End Identification Lights
RFFS	Rescue and Fire Fighting Services
RPT	Regular Public Transport
TSR	Transport Sector Review
UN	United Nations
UNAMA	United Nations Assistance Mission in Afghanistan
UNHAS	United Nations Humanitarian Air Services
UNJLC	United Nations Joint Logistics Centre
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Radio Range
VSAT	Very Small Aperture Terminal
WI	Wind Indicator

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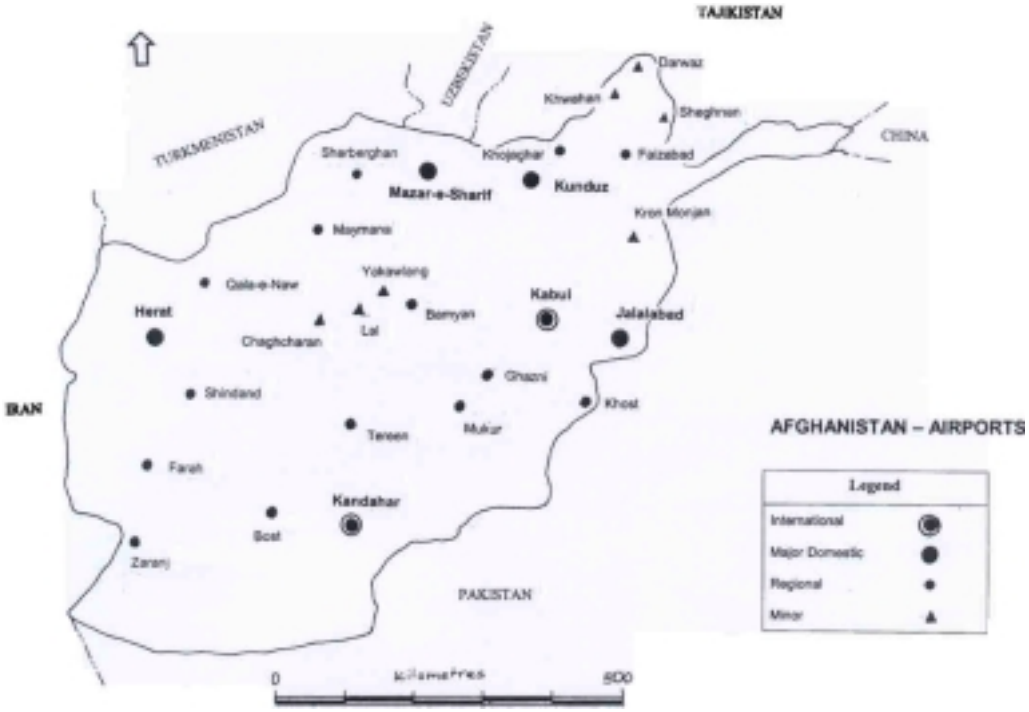
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Bamyan
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AFGHANISTAN – AIRPORTS
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Executive Summary

Airport rehabilitation projects are urgently required at most locations to support resumption of regular domestic air services in Afghanistan. The main issues which need to be addressed to support these projects are:

1. Project Management

A project manager should be appointed to review and prioritise the projects, identify and negotiate donor funding, and implement the works.

2. Capacity Building

Capacity building across the entire civil aviation sector must commence as quickly as possible and will be an ongoing process for the next 5 to 10 years. In particular, recruitment and training of airport management and maintenance personnel, preparation of manuals and guidance materials, and provision of adequate office accommodation, transport, tools and equipment. This process will need to be supported by donor funding and TA programs.

3. Documentation

A comprehensive review of all existing civil aviation documentation and procedures is required, and new updated documentation[1] needs to be prepared and published.

4. Development Controls

Many projects to assist in the reconstruction of the air transport sector are currently proceeding or are being proposed by foreign companies, particularly at Kabul Airport. A review and coordination process is urgently required to ensure that accepted projects are compatible with long term planning, standardisation, environmental and operational objectives and will not result in unnecessarily high life cycle cost penalties.

[1] This will include such things as Aeronautical Information, maps and charts, manuals and airport master plans.

1. Introduction

1.1. Background

After a long period of conflict, the pre-existing civil aviation infrastructure of Afghanistan has been devastated and the availability of trained personnel across all facets of administration and technical areas has been severely depleted. Domestic airlines ceased operations in the early 1990s and to date, only Ariana has restarted skeleton services to a few ports.

Limited domestic air transport services are currently provided on a temporary basis by various United Nations (UN) agencies and Non Government Organisations (NGOs). Ariana is slowly rebuilding its international fleet and re-establishing regional and European services, and a small number of other international airlines are currently serving Kabul.

Afghan airspace, apart from flight levels designated for overflights which are handled by Afghan civil controllers, is under the control of the US led Coalition Forces, as is Kandahar airport which is the main US base. Kabul airport is under the control of the International Security Assistance Force (ISAF) and most other domestic airports are controlled by local military forces, however, it is believed that control will revert to the civil authority when MCAT is in a position to properly manage and staff the airports.

At present, there are no functioning navigation aids or meteorological facilities in the country and practically all of the previous aviation communications system is destroyed or not operating.

There is an urgent need to restore Afghan control and management of civil aviation to support regular public transport (RPT) air services on both international and domestic routes and overflights. This will require re-establishment of:

- basic airport infrastructure to the appropriate standard;
- CNS/ATM services and adequate civil air routes;
- the civil aviation administration and technical support services;
- staff recruitment and training; and
- funding mechanisms for civil aviation.

1.2. Timeframe

The timeframe adopted in this paper for the reconstruction of Afghan airports is five to six years, allowing for donor mobilisation, design, procurement and

construction. However, the planning process which underlies the airport upgrading recommendations has necessarily considered the next 10 to 15 years for the purpose of seeking a return to normality, in relation to capacity building within both the airlines and the civil aviation administration and the end of foreign military domination and control for which no timeframe has been advised but which could continue up to 2010 or longer.

1.3. Objectives of this Study

The purpose of this study was to assess the existing condition of the civil aviation infrastructure, chiefly the airports, and to define the works necessary to restore the infrastructure to a standard suitable for resumption of civil aviation in Afghanistan. Where practicable, staged airport development strategies have also be recommended. Indicative cost estimates are given for all of the works sufficient for bankable projects to be presented to and be considered by potential donors. Recommendations to strengthen the institutional structure of civil aviation have been made in the Transport Sector Review (TSR) Policy Paper. Comment is made in this report on those aspects relevant to airport planning, design and construction, safety and standards, airport management and maintenance, and CNS/ATM.

This report:

- documents the planning philosophy adopted for development of domestic airports in Afghanistan to a standard appropriate to the expected traffic;
- discusses the physical and operational standards applicable to the domestic airports;
- examines the existing conditions at ten domestic airports;
- details the works required to rehabilitate/upgrade the airports with indicative cost estimates; and
- sets out an implementation program and packages of bankable projects.

1.4. Conduct of the Study

1.4.1. Clarification of the Brief

At the outset, it was clarified with Technical Deputy Minister Alami that the team would be focussing on the major regional and sub-regional airports. It was agreed that detailed planning and facility development of Kabul International airport would not be considered because a number of upgrading projects had already been negotiated with various foreign companies and potential donors. ISAF is also actively contributing to this ongoing process.

Additionally, Kandahar airport is used by the coalition forces for military operations which are likely to continue for some time. As yet, there is no defined timeframe for the reopening of this airport for regular civil aviation operations and negotiations will need to be carried out between MCAT and the coalition forces to achieve a resolution to this situation. Therefore, an alternative strategy to provide civil air transport facilities to Kandahar is outlined in this report, in the event that the existing airport does not become available within a reasonable timeframe.

1.4.2. Site Inspection Visits

Airport Development Engineer Mr. Malcolm P. Dow carried out field inspections utilising the scheduled services of UNHAS, UNAMA and PACTEC/AirServ. Most visits were brief due to the flight schedules, but were sufficient to assess major items of infrastructure such as pavements, buildings and obstructions. Assistance and advice provided by the flight crews and MCAT and WFP personnel at some ports is gratefully acknowledged.

It had been intended that counterparts from both MCAT and MPW would accompany Mr. Dow on the field trips. Unfortunately, due to the lengthy approval and booking procedures, in addition to flight cancellations because of bad weather in the north of the country, this was not possible.

The following airports were visited:

13 April, 2003 Kandahar; Herat

15 April, 2003 Jalalabad

20 April, 2003 Kunduz; Faizabad.

22 April, 2003 Mazar-I-Sharif; Bamyan.

27 April, 2003 Chaghcharan; Lal (overfly); Yakawlang

1.5. Acknowledgements

The assistance and cooperation of numerous MCAT, UN and NGO staff in Kabul and outstations during the course of the study is gratefully acknowledged, as are the contributions made by the authors of numerous previous reports on the airports and CNS/ATM, observations and recommendations from which have provided invaluable input to this report.

1.5.1. Previous reports referenced in this study

Report on Survey of Provincial Airports by the Ministry of Civil Aviation and Tourism and ICAO. ICAO, June 2002.

Airport Assessment Afghanistan – Mazar-I-Sharif, Faizabad, Chaghcharan. Swedish Rescue Service Agency, Swedish Civil Aviation Administration, July 2002.

Report on Air Navigation Services Needs. US Federal Aviation Agency, September 2002.

1.5.2. People met and/or consulted

Eng. Raz Mohd. Alami	Technical Deputy Minister, MCAT
Mr. A R Qaderi	President of Planning, MCAT
Mr. A Q Basharyar	President, Civil Aviation Operations, MCAT
Mr S. K. Zewari	Technical President, MCAT
Mr. M. Tahir	Vice President, Civil Aviation Operations, MCAT
Mr Mohammad Atar	Vice President, Flight Safety, MCAT
Mr. Q Ahmadi	Flight Safety Officer, MCAT
Mr. K. U. Abawi	President of Laws and Air Transport Agreements, MCAT
Mr. Ghulam Ali (Timar)	General Manager Kabul International Airport, MCAT
Mr. F. M. Fedawi	Vice President OPNS/TECH, Ariana Afghan Airways
Dr. Eng. M Yaqoob Shaghasy	Deputy Minister, MPW
Md R Shafaq	President of Planning, MPW
Eng. Marzia Fahim	Responsible for the Airport Office, MPW
Mr. David Moores	ICAO, Bangkok Office
Mr. Malik Mortaza	Advisor, AACA
Mr Alex Park	Manager, Design and Feasibility Unit, AACA
Mr. Tony Tucceri	Air Operations Manager, UNHAS
Mr. Philippe Martou	Air Operations Manager, UNHAS
Mr Franz Zenz	President, Tryco
Dr. Aziz A Atif	Liaison Officer, Tryco
Mrs. M Wahlstrom	Head of Mission, UNAMA
Mr. Gary Helseth	UNOPS Country Manager

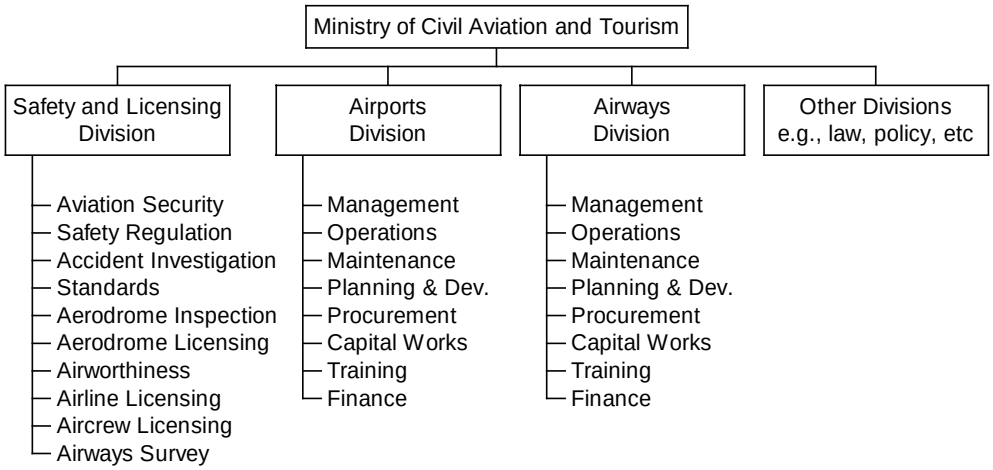
Mr. John Woodberry	PACTEC Program Director, Afghanistan/Pakistan
Capt. Daniel Kelly	PACTEC
Mr. Sakhidad	ATC, Herat airport
Sq. Ldr. John Noone	Coalition Forces Air Component Commander Local Liason (CFACC LNO (ATC))
Mr. Ghulamraza	Technical and MET officer, Herat airport
Mr. Abdul Ahed	Fire Chief and Airport Manager, Herat
Mr. Farid Ghiasi	UN Flight Coordination Officer, Jalalabad

2. Institutional Issues

2.1. Structure and Organisation

Responsibilities for commercial, operational, regulatory and safety matters should be clearly separated in an ideal civil aviation environment. This is not the case in the present Ministry of Civil Aviation and Tourism (MCAT) organisation.

A suggested structure for civil aviation in Afghanistan, which would provide the necessary separation of functions in relation to safety, airport management and air traffic management is outlined in the chart below.



Principal responsibilities of the safety and licensing division and the airports division are clear from the diagram. Airways Division would provide the following facilities and services:

- Communications (COM)
- Navigation Aids (NAVAIDS)
- Air Traffic Management (ATM)
- Meteorological Services (MET)
- Aeronautical Information Services (AIS)
- Search and Rescue (SAR)
- Management of the Civil Aviation Training College (CATC)

The three divisions (Safety and Licensing; Airports; and Airways) will require capacity building for at least 4 or 5 years until a sufficient nucleus of trained and experienced staff is available. This process will need to be assisted by donor funded TA programs in many disciplines.

The divisions would operate as independent cost centres, developing revenue streams and accounting for all operating costs.

Inside the Airports Division, it is proposed that the airports would be organised and managed on a regional basis such that a main centre will be responsible for nearby smaller airports, generally those which are served by feeder services from the main centre. This would facilitate the movement of technical and maintenance personnel.

A possible arrangement is shown below.

Central	**South**	**West**	**North**	**North East**
KABUL	KANDAHAR	HERAT	MAZAR-I-SHARIF	KUNDUZ
Jalalabad, Khost, Ghazni, Bamyan, Yakawlang, Lal, Chaghcharan, Kron Monjan	Mukur, Tereen, Bost, Zaranj, Farah,	Shindand, Qala-e-Naw	Maymana, Sherberghan	Faizabad, Khojaghar, Khwahan, Darwaz, Sheghnan

Headquarters of the Airports Division would be located in Kabul and would contain the main technical office, stores, group finance, human resources and other service departments.

It is possible that the Airways Division could be organised in a similar fashion, with a main store and technical centre in Kabul and technicians and local spare parts holdings in the regional centres to support the operating staff.

At an appropriate time in the future, it is envisaged that the three divisions, i.e. Safety and Licensing, Airports, and Airways, would be removed from MCAT and established as government owned companies.

The next step, privatisation, may be a future option for the civil aviation sector in Afghanistan but is not considered to be practical for at least 10 years.

2.2. Special Issues

2.2.1. Gender

Gender issues in Afghanistan are complex and deeply rooted in culture and recent experience. The civil aviation sector could be a leader in providing equal opportunities, accessibility and security for women, both employees and customers, most particularly, female air travellers.

Creating an environment where women can travel freely and safely by themselves, without a close male relative escort, is an essential requirement of Afghanistan's modern transportation system in which air travel plays a major part. The groups most in need of this include businesswomen and widows (estimated at 700,000).

A large number of new employment opportunities will be created in the aviation industry in the next 10 years as capacity building proceeds. The great majority of positions and tasks can be done just as well by women as men. Therefore, in the ASB, AAA and ACA, there will be many opportunities to recruit and train women in all facets of administration and operation. Airlines are also employers of many women, in all kinds of positions, from booking clerks, check in (customer service) to managers and pilots.

2.2.2. Handicapped

Afghanistan has, unfortunately, one of the highest populations of handicapped and disabled people in the world. Most of these people are men who need employment and a responsible position to help regain respect and self-esteem. Due to the critical staffing position in the civil aviation sector, and the need to recruit and train a large number of competent people within a relatively short time, this resource should not be ignored.

2.2.3. Environment

Environmental issues have not previously been of critical concern to Afghanistan's leaders or industries. Such issues can no longer be ignored in the modern globalised world. Civil aviation must issue an environmental policy and conduct its business in awareness of that policy, and of national environmental law, when that is implemented. Environmental aspects and implications should be considered in all administrative, operational, planning and construction activities.

2.2.4. Recommendations

It is recommended that:

1. a position be created in MCAT to oversee gender, accessibility and handicapped issues in civil aviation[2].

2. environmental awareness subjects be included in all training courses for civil aviation personnel.

[2] It would send a powerful message if a suitably qualified woman is appointed to the position.

3. Airports

The principal objective of this study was to assess the existing situation and determine the appropriate rehabilitation works required at specific airports in Afghanistan.

The standard of facilities required and hence, the scope of works is dependent upon the expected level of traffic or aviation activity (measured in terms of daily or annual aircraft and passenger movements[3] and the maximum size of aircraft expected to be operating at the airport).

A short explanation of the methodology used to determine facility requirements is given below as background to the airport rehabilitation recommendations.

3.1. Determining Requirements for Airport Facilities

The operational capability of an airport is determined by a number of factors, the most significant being:

- physical characteristics (chiefly runway and runway strip dimensions);
- pavement strength;
- surrounding terrain and natural or man-made obstructions in the approach/take-off and circling area; and
- standard and availability of communications, navigation and landing aids; airport and obstruction lighting; rescue and fire services and terminal facilities.

Currently in Afghanistan the airport infrastructure is severely degraded and many facilities either do not exist or are not functioning at full capacity. The immediate challenge is to restore facilities to a standard commensurate with the desired level of civil aviation activity at the specific airports. In order to achieve this it is necessary to have an indication of the level of operations, i.e.

- size of aircraft
- daily frequency of flights
- number of aircraft on the ground at any one time (and hence the number of passengers and baggage needing to be processed through the terminal building)

[3] An aircraft movement is either a take-off or a landing; a passenger movement is either an arrival or a departure (transit passengers are not included).

There is no historical data relating to domestic passenger and freight movements and no recent forecasts appear to have been made. Therefore, estimates of domestic air traffic demand have been produced by the consultants to provide a rough basis and justification for the airport rehabilitation and upgrading works (refer Appendix 1).

3.1.1. Number of Airports

There is no official up to date inventory of airports, the last AIP having been published in December 1990. United Nations Joint Logistics Centre (UNJLC) publishes a list of airports on its website which was last updated in January 2003. The consultants have compiled a composite list of airports (refer Appendix 2 for details) which indicates there are 27 airports in total. Of these, four (Farah, Ghazni, Khost and Mukur) are listed as unuseable by UNJLC. However, it is known that PACTEC is currently operating to Farah and one or two other unlisted airports. There are also at least two airports presently under construction, one at Taloqan and one in Nuristan.

3.1.2. Airport Classification

The Afghanistan AIP makes no distinction between different standards of airport apart from Kabul and Kandahar which are classified as International. It is inferred however, that Herat, Mazar-I-Sharif, Kunduz and Jalalabad are considered to be major domestic airports due to traffic levels and size of the existing facilities.

For the purpose of discussion in this paper, airports have been assigned one of four classifications based on runway dimensions, implied aviation activity and level of existing facilities, as shown in the following table.

Airport Classification		***Airports***
1	International	Kabul, Kandahar
2	Major Domestic	Kabul, Kandahar, Herat, Mazar-I-Sharif, Kunduz, Jalalabad
3	Regional	Faizabad, Maymana, Bamyan, Chaghcharan, Farah, Ghazni, Khost, Qala-I-Naw, Sherberghan, Shindand, Zaranj, Bost, Khojaghar, Tereen, Mukur
4	Sub-Regional	Lal, Yakawlang, Darwaz, Khwahan, Kron Monjan, Sheghnan

3.2. Design Standards

The International Civil Aviation Organisation (ICAO) has developed standards and recommended practices to ensure the safety and efficiency of air transport and airport facilities. In particular, aerodrome physical standards are defined and explained in detail in ICAO document Annex 14. These standards and recommended practices have been adopted as the basis for the airport planning undertaken in this report and are discussed in Appendix 3.

3.3. Design Aircraft

Generally, the design (or critical) aircraft is taken as the largest aircraft that is expected to be handled in the design period, as this will deposit the largest passenger load at the terminal, take up the largest amount of apron parking space, require the largest quantities of fuel and provisioning, and so on. Usually, the critical aircraft will also determine runway length and pavement requirements although this may not necessarily be the same aircraft type as is critical for the terminal and parking bay.

3.3.1. Design Aircraft for Afghanistan Airports

International

The B767/B757 and similar sized aircraft such as the A310 and A300 in the 180-260 seat range, have found wide acceptance throughout the world as regional aircraft where service frequency is paramount but traffic does not support the larger B747. This is expected to be the situation for Afghanistan for the foreseeable future. Additionally, operational constraints at Kabul airport due to close proximity to high mountains and severe winter conditions are not conducive to regular B747 operations. Discussions with Ariana established that this is in line with their fleet planning for regional / international services.

Domestic

For domestic services, Ariana's intentions are to operate a range of aircraft from 150 seat capacity (e.g. B727/B737) down to around 20 seats[4], depending on airport capability and passenger demand. The remaining useful life of Ariana's B727s is estimated at 4 to 6 years. A 50 to 70 seat aircraft is considered by Ariana to be most suited to service most major domestic and some regional airports at the present time. Typical aircraft examples are the

[4] The actual aircraft chosen by the operating airline(s) would depend on many factors but principally the operator's own assessment of the most suitable aircraft. In the long run, a B737 variant would probably be the most flexible and economic aircraft for the most heavily trafficked routes. Ariana's current equipment (B727 and A300) might be used as a stop gap measure but these aircraft are considered to be unsuitable as both are too large for domestic services and the B727 is noisy, old technology, and expensive to operate.

Antonov 24 (AN24) – a 50 seat twin turboprop, and the Fokker F28 (F28) – a 65 seat twin turbojet[5].

The design aircraft assumed for Afghanistan airports on the basis of the above discussion are listed in the following table.

Airport Classification		*Design Aircraft*	*ICAO Reference Code (refer Appendix 3)*
1	International	B767 occasional B747	4D
2	Major domestic	B737/B727	4C
3	Regional	AN24/F28 or smaller (varies)	3C or lower (varies)
4	Sub-Regional	Twin Otter or smaller	1B

3.3.2. Physical Standards for Design Aircraft

The following dimensions which are based on ICAO standards and recommendations (refer Appendix 3) are the recommended design targets for the rehabilitation and upgrading of Afghanistan airports.

		Runway				*Taxiway*	
Design Aircraft	*Code*	*Width (m)*	*Max. Transverse Slope*	*Shoulder Width[a] (m)*	*Strip Width (m)*	*Width (m)*	*Strip Width (m)*
B747	4E	45	1.5%	7.5	300 [d]	23	95
B767	4D	45	1.5%	3.0 [c]	300 [d]	23	81
B737 / B727	4C	45[b]	1.5%	3.0	150 [e]	23	52
An-24 / F28	3C	30	1.5%	3.0	80[f]	15	--
Twin Otter	1B	18	2.0%	--	60	10.5	--

Notes: a) If shoulders are provided.

[5] In practice a wide range of both new and second hand aircraft is available through either purchase or lease arrangements. Refer to Appendix 3, Table 3 for more examples.

b) ICAO Annex 14 specifies 45m wide runways for code 4C aircraft, however, many states permit B737 operation on 30m wide runways and directional stability tests have proved this to be a safe practice.
All major domestic airports in Afghanistan have 45m wide runways.

c) It is considered prudent to provide 7.5m wide paved shoulders for B747 to prevent ingestion of foreign objects into the outboard engines, which overhang the edge of the 45m wide runway.
The B767 engines do not overhang the 45m wide runway, so 7.5m wide shoulders are not necessary for this reason.

d) Precision approach runway.

e) Non-precision approach runway.

f) Daylight VMC operations only (VMC = Visual Meteorological Conditions).

3.4. Airport Inspections

The following airports were inspected during April 2003: Herat, Jalalabad, Mazar-i-Sharif, Kunduz, Bamyan, Faizabad, Chaghcharan, Lal (overflight) and Yakawlang.

Kabul airport was not officially inspected but several discussions were held with the Airport General Manager.

A stopover was made at Kandahar airport but it was not possible to make arrangements with the coalition forces at short notice for an inspection. A planned visit to Maymana was cancelled due to security concerns.

3.4.1. Infrastructure

During the inspection visits it was noticed that there are similarities between the existing infrastructure at many airports. For example, all the major domestic airports have paved runways (generally asphalt) which were constructed at about the same time and all are now exhibiting similar symptoms due to lack of maintenance in addition to war damage. Also, a standard terminal building design is used at most airports, invariably with a control tower cabin on the top.

General comments on infrastructure items will be made in this section to avoid repetition in the later airport description sections.

Runways and other aircraft pavements

The original construction of the runways (mostly around 40 years ago) appears to have been to a high standard. However, because of long periods of minimal maintenance the asphalt surfacing shows signs of severe ageing, embrittlement and loss of bitumen. Extensive longitudinal and alligator

cracking, ravelling (loss of stone) and some potholing is evident on most pavements. There are surprisingly few failures due to overloading and/or wet underlying pavement layers. Similar observations apply to the existing taxiways and aprons.

Most runways and some other pavements have had asphalt overlays at some time in the past 15 years or so, some as recently as 2 years or less. Generally the area treated has been limited to the central section of the runway (typically 15 m wide) and parts of taxiways and aprons. In all cases there has been no level control and the surfaces are rough and undulating; and for older overlays, also showing signs of ageing distress. All of the paved runways appear to have been constructed with a central crown and loss of cross sectional shape has occurred to a greater or lesser degree on runways, taxiways and aprons at all airports inspected. This results in drainage problems, particularly water ponding, and poor riding quality for aircraft ranging from moderate to unacceptable.

All pavements received war damage, generally in the form of bomb craters. At the airports inspected, this damage had nearly all been repaired. The quality of repairs could not be ascertained but is expected to be variable and it is likely that further remedial work might be necessary as part of the rehabilitation projects prior to construction of new asphalt overlays.

On the evidence of pavements which have been inspected, it is clear that all existing asphalt pavements will need asphalt overlays in order to restore proper longitudinal and cross sections and surface texture. The amount of asphalt required on any single runway will be dependent on the amount of shape which needs to be corrected and planing of the surface may be required in some instances to remove high areas. A pavement assessment and some testing, in addition to detailed survey of the pavements and surrounding area will be required for design of the overlay and associated works in each case.

Airfield markings

No airport inspected had standard pavement markings and most have none at all. After pavement reconstruction, pavement markings complying with Annex 14 should be applied. This will include runway centreline and runway edge markings, touchdown, runway identification, taxiway centreline and edge markings, apron lead lines and aircraft parking positions.

A circular cleared area around each windsock (wind indicator) should be prepared and marked with white stones. The surface inside should be darkened with sump oil to provide contrast to the windsock sleeve as seen from the air.

The AIP defines a number of visual ground signals used to communicate messages to pilots, particularly at smaller airports where radio communication may be unreliable or non-existent. If this system is to be retained, a signal

circle should be prepared in the same way as, and adjacent to, the windsock circle and the appropriate signal materials provided to each airport.

Runway strip

None of the airports inspected had a defined, or cleared, runway strip complying with Annex 14 requirements. Most appeared to have had originally, a 90 m wide graded strip. Typically, the strips are now overgrown with weeds and shrubs and many contain obstructions such as rocks, boulders, mounds of earth, and wrecked vehicles and aeroplanes.

Strips will need to be re-established at all airports and strip markers provided (e.g. gable markers or plastic cones). In some cases, drainage works might be required. Arrangements will need to be put in place for regular mowing of strips where necessary and for runway and strip inspections every day, generally before the first flight of the morning.

War wreckage

A large amount of war wreckage is evident at most airports, including destroyed buildings, wrecked aircraft and vehicles, earthworks, engines, and metal pieces. Many of these items obstruct the runway strip or clearance surfaces associated with landing and takeoff. Apart from the danger to aircraft using the runways, this debris is unsightly and in the case of wrecked aeroplanes, could be unsettling to passengers.

It is a priority at every airport to remove this wreckage out of sight as quickly as possible.

Terminals

A similar design of terminal is used at all the major domestic airports. Generally the buildings are in poor condition and do not have modern heating, lighting, toilets or plumbing. Most are currently occupied by the military. Internal design is based on an office layout and there is no large space suitable for processing large numbers of air passengers or their baggage.

It is considered that airports which will not normally be handling aircraft larger than 50 seats, i.e. AN24, could make do with the existing terminal, appropriately renovated to provide reasonable space for check-in, passenger waiting, outwards baggage processing, arrivals baggage collection, and airline offices. Facilities should also include a good standard of male and female toilets, appropriate provisions for handicapped and disabled passengers and staff, including toilets, and a restaurant. In this case, the control tower cab on top of the building might also be renovated and made suitable for ATC or flight service accommodation.

At airports where B737/B727s will be operating, provision of a new passenger terminal and a new control tower/ operations/ communications building is recommended. There is not a strong case for combining the terminal and control tower as in the past as the functions are completely separate.

Fire station

All former fire station buildings are either destroyed, derelict or being used for alternative purposes, and no equipment remains. At airports where a rescue fire service can be justified, provision of a new, modern facility is recommended. Where only a small establishment is required, consideration could be given to combining the RFFS and ATS facilities in the same building.

The airport rescue and fire service needs to have ready access to all of the aircraft movement area, parts of the approach and takeoff areas close to the airport, the aprons and airport buildings, both landside and airside. It also has to meet response time targets set by ICAO, and its performance in this regard will be determined to a large extent by the location of the facilities and the types of equipment provided. Preferred locations are away from major buildings and aprons but with ready access to the runway, taxiway and airside road system.

The fire station should include the following features:

- Under cover parking bays for fire tenders, with provision for extension. The number of bays will be determined from ICAO guidelines, according to the airport category. At least one parking bay should include a pit for maintenance.
- A watchtower cabin on top of the building with appropriate communication facilities.
- Fire crew training room, lunch room and amenities.
- Administrative office.
- Secure equipment storage area
- Foam storage area.
- Water storage tank for filling tenders or standpipe with guaranteed supply.
- Hose drying tower and exercise facilities (e.g. volley ball court).
- Outside hardstand for vehicle standing and washdown.
- Airside access road to taxiway/runway.

Car park and access road

All car parks and access roads inspected were in poor condition and need to be reconstructed and sealed. The length of airport road necessary to gain access to the main highway varies and a nominal length has been allowed at each airport.

Fences and Gates

Existing security arrangements at Afghanistan airports are quite lax and trespass of unauthorised persons and animals onto airport property is common. Boundary fences need to be re-established at all locations and apron security fencing with appropriate gates is required to maintain security and safety on the airside, particularly around operating aircraft.

Electric power, water and sewerage

Some airports have connection to the municipal power supply but in all cases this is unreliable. A variety of engine generators (EG) is installed at some airports, many of these are unreliable or unserviceable. Some airports do not have generators. For the purpose of this report, it is assumed that new EGs of appropriate capacity will need to be provided as part of the rehabilitation works. Should the existing EG prove to be satisfactory or capable of being repaired, this can be accommodated in the detailed project design phase.

Existing water supply and sewerage systems at all airports are assumed to be in need of complete replacement for the purposes of cost estimates.

Control tower, operations, communications

Refer to comments under Terminal and Fire Station. As all control tower and communications equipment will be supplied new (apart from some recently supplied equipment which could be relocated from existing buildings) it would be sensible to install it in new purpose built, air conditioned buildings where possible. The existing control towers typically have steep access stairs which do not meet accepted standards of occupational health and safety.

If the operations building houses the pilot briefing and meteorology offices, this should be readily accessible to flight crews from the airside.

The control tower requires an uninterrupted view over all of the movement area and the approach and circuit area. Typically, it will be sited near the centre of the airport to achieve sight distances to the runway thresholds. It is also advantageous if the controllers can see aircraft on the apron so that movements can be monitored from engine start-up to entry onto the taxiway and vice-versa.

The main siting and design criteria for the control tower are:

- The cabin should be high enough so the controllers can see the runway ends, as much of the movement area as possible, and the approach and circuit areas. The need for a high structure can sometimes be avoided by siting the control tower on high ground in the airport.

- The cabin roof should be capable of taking all the required communications aerials and should be provided with a hoist for raising and lowering items of equipment onto the roof and into the cabin.

- Amenities (toilet, kitchen, rest room) for the controllers should be provided on a level immediately below the cabin level.

- An emergency exit **must** be provided in case of fire.

- Reliable air conditioning and power supply must be provided to safeguard the integrity of the equipment and to maintain comfortable working conditions.

- Window glass and frames should be designed to be non-glare and minimum obstructions to line of sight. If double glazing is used, careful attention must be given to avoidance of condensation between the panels.

A control tower would normally only be provided at major airports and airports at which turbine engined aircraft operate on high frequency RPT services.

Meteorology equipment

No meteorology equipment currently exists. The FAA report made recommendations for replacement equipment. It is understood that the government of Japan is arranging for the supply of basic equipment to all airports in the near future.

Airport lighting and visual aids

There are few visual aids and no airport lighting at any airport apart from temporary military installations at Kabul and Kandahar.

Major Domestic airports with a non-precision instrument approach runway would require provision of the following visual aids:

- Runway, taxiway and apron pavement marking

- Wind indicators (one, designated the Primary Wind Indicator and located adjacent to or near the apron area, should be illuminated)

- Aerodrome beacon

- Runway edge lights

- Runway threshold identification lights

- Runway end lights

- Taxiway edge lights

- Visual approach slope indicator system[6] (e.g. PAPI)
- Simple approach lighting

A low intensity system with 3 stages of intensity which would be suitable for both daylight and night conditions is recommended. Due to the low frequency of traffic and the wind patterns at the airport sites, it is considered that airport lighting which supports a single ended approach would suffice at most locations.

The airport lighting system requires a power supply and an appropriate control and monitoring system so that it can be operated from the control tower. A generator with capacity around 30/35KW would be sufficient to power the airport lighting system and a VOR/DME, if provided.

Navigation aids

There are currently no operational navigation aids in the country.

FAA has commented that GNSS-based procedures are a cost-effective way to introduce instrument navigation services to airports in Afghanistan. IATA has developed GNSS-based non-precision approaches for Kabul, Mazar-i-Sharif, Herat, Kandahar and Jalalabad, although they are not yet flight tested. Consequently, FAA believes that future installation of ground based navigation aids should be limited to locations where adequate cost benefit justification exists, and, furthermore, that procedural non-radar could provide the transitional step to modern CNS/ATM capabilities.

For the purpose of cost estimates in this report, it is assumed that conventional ground based navigation aids will be required at most airports.

An instrument runway requires at least one navigation aid, most commonly an NDB. This will enable a number of basic instrument approach procedures. Consideration should be given to reinstatement of NDBs at major domestic and some of the larger regional airports, such as Bamyan, Faizabad, Maymana and Farah, and possibly some smaller, remote sites.

It is recommended that a co-located VOR/DME be provided at each major domestic airport which will enable a lower minima for non-precision approach procedures, contributing to improved safety and precision of the procedures, assuming that the domestic fleet is equipped with VOR and DME. Additionally, the VOR/DMEs would serve as en-route aids for overflights.

Airport maintenance

Organised, regular airport maintenance activities are currently non-existent. Apart from Kabul airport where a small maintenance team is working under

[6] Provision of a visual approach slope indicator system is a mandatory Annex 14 requirement for runways used by turbojet aeroplanes on RPT services.

the direction of the Airport General Manager, MCAT is not performing any form of airport maintenance. Some special maintenance tasks are being carried out by contractors, e.g. runway overlay at Herat, war damage repairs at Mazar-i-Sharif, concrete parking and start up pads at a number of small airports with gravel runways.

A detailed discussion of airport maintenance is given in section 3.6. Proper facilities are required at each airport to support the maintenance effort. Most important of these are tools, plant and equipment, vehicles and a secure compound or shed in which to store all equipment when not in use. The compound may also contain workshops, spare part storage, materials, staff amenities and the like.

Airport plans and survey

It was not possible to find any airport plans (other than those in the AIP) or survey information in MCAT or at the airports. Even if this information does exist, it would be significantly out of date in many respects. The airport drawings contained in this report are sketch plans only.

Prior to undertaking the design of any rehabilitation works it will be necessary to obtain requisite physical and cadastral survey information and produce airport plans showing all existing features and facilities. Soil surveys and pavement testing and evaluation will also be required.

Airport master plans

No airport master plans currently exist. It is recommended that these be carried out for all airports as soon as possible to enable coordination of all development proposals, including the rehabilitation works defined in this report.

Aviation refuelling facilities

Most major domestic airports formerly had refuelling facilities but all are either destroyed or unserviceable. This report does not consider rehabilitation of these facilities but assumes that the airlines will make their own arrangements with the fuel suppliers. MCAT's role, if requested, is to allocate appropriate sites which comply with clearance requirements for storage of aviation fuels and are in accordance with the airport master development plan.

Airline support facilities

Few airline facilities were noted at the major domestic and regional airports. Airport planning should make allowance for the future development of airline support facilities at the major airports including the following:

- Aircraft maintenance / storage hangars and workshops
- Freight facilities

Detailed specifications for these or other facilities would be developed by the airlines as required.

3.5. Recommended Works

A brief summary of existing conditions and the recommended works at each airport are described in this section. Works are prioritised as follows:

Stage 1 Urgent, should be completed within 1 to 3 years

Stage 2 less urgent but essential, should be completed within 3 to 6 years

3.5.1. Summary of costs

Airport	*Stage 1 Estimated Cost (USD)*	*Stage 2 Estimated Cost (USD)*
Mazar-i-Sharif	$2.91M	$2.33M
Kunduz	$2.18M	$1.68M
Herat	$3.42M	$1.93M
Jalalabad	$2.16M	$1.83M
Faizabad	$1.15M	$0.05M
Bamyan	$0.35M	$0.73M
Chaghcharan	$0.65M	$0.14M
Yakawlang	$0.58M	$0.24M

Refer to Appendix 4 for the principles for preparing costs.

3.5.2. Kabul

This study does not consider Kabul International Airport in detail as it is currently receiving considerable attention from a number of other areas and many rehabilitation projects are either commencing shortly or will be approved in the near future. These projects include installation of VOR, DME and ILS, runway overlay, runway lighting, visual slope indicators, terminal building renovations, cargo apron expansion and aircraft fuelling improvements. It is understood that these projects will be funded by World Bank credits.

The airport presently supports limited Ariana flights (international and domestic) and several other international carriers, in addition to operations conducted by UN and other agencies and the military (ISAF), which also provides all ATC services. With the planned improvements and the investment necessary to enable domestic services to re-start, the airport should have adequate facilities to support civil aviation in the short to medium term.

It is understood that a replacement airport for Kabul was investigated some 30 years ago, and a site was selected at Logar, some 45 km south of the city. The chief advantages of the proposed relocation are said to be the lessening of operational constraints which currently apply at Kabul Airport due to the close proximity of high mountains, avoiding encroachment of the existing site by new housing and the opportunity to release valuable land close to the city for commercial and other development. Due to the significant number of competing priorities for national development over the next 5 or 6 years, and the heavy investment which will occur in the short term at Kabul Airport, it will clearly not be practical to consider relocation to the new site for another 15 to 20 years.

The following recommendations are made in respect of Kabul International Airport:

No.	Recommendation	Priority
1	A Kabul Airport Coordination Unit (KACU) should be created within the MCAT. KACU's task is to ensure that all interim developments are in accordance with an agreed airport master plan (refer recommendation 2), meet applicable international standards, and will not compromise future management, operational and maintenance requirements[7].	Urgent

[7] The observations and comments contained in clauses 3.9.7, 3.9.7.1 and 3.9.7.2 of the FAA Report (September 2002) are also relevant and apply generally, not only to CNS/ATM issues. Briefly it states that acceptance of offers from foreign companies, without a comprehensive review of the implications, in a bid to plug immediate gaps in facilities or operations, may entail continuing life cycle and maintenance costs and provide solutions that are incompatible with long term needs and planning.

No.	Recommendation	Priority
2	Conduct a master plan study for Kabul Airport, including aviation forecasts and a prioritised 20-year development plan.	Urgent
3	Place planning controls on development around the airport to prevent encroachment of the boundaries and airport clearance surfaces (e.g. approach/takeoff area, horizontal surface). If controls currently exist, they should be critically reviewed, allowing for the master plan requirements.	Urgent
4	Develop a new international terminal and separate control tower in appropriate locations as determined by the master plan.	Within 5 years
5	Develop a new domestic terminal (possibly combined with the international terminal).	Within 5 years
6	Consider the provision of an emergency runway suitable for landing of B767/Airbus type aircraft which could also be used regularly by AN24 and smaller aircraft types[8].	3 to 6 years
7	Review the feasibility study for the replacement airport in ten year's time and defer any decision to relocate until then.	2013

[8] ICAO has expressed concerns regarding the ramifications of an extended runway closure at Kabul. Refer to section 5.7.7.

3.5.3. Kandahar

Kandahar airport is currently wholly occupied and controlled by the US Military. Whilst UN aircraft are permitted to use the runway and a remote hardstand, RPT services are not, and no facilities of any kind are available. There is no defined timeframe for the reopening of Kandahar airport for RPT services, therefore, this situation could last for a considerable time. Even when the coalition forces leave, there will be considerable rehabilitation and upgrading work to be done on the buildings and movement areas which would take at least one year to complete.

This being the case, it is recommended that consideration be given to establishing a temporary airport at Kandahar for interim civil use. Should a suitable site be identified and proven to be feasible, particularly in relation to airspace compatibility with the military operations, the airport requirements are outlined below. This would provide a basic AN24 standard airport including night operations, at minimal cost, which would also be capable of accepting limited B737/B727 flights subject to the appropriate dispensations being issued by MCAT.

Item	***Standard/Facility***
Airport Status	Domestic
ICAO Code	3C
Design aircraft	AN24 (limited B737)
Runway	1800 x 30 (gravel, sealed ends)
Runway shoulders	No
Runway strip width	150
Taxiways	Single 15 m taxiway to apron, bitumen sealed
Apron	For 3 x An24, 120 x 70, bitumen sealed
Terminal	Basic, for domestic use only, air conditioned
Air Traffic Services	Flight information only
Rescue Fire Service	No
Navaids	NDB
Airport lighting	Runway and taxiway edge lights, PAPI, apron floodlighting
Aircraft fuelling facility	No

Notes:
a) A 30 m runway is sufficient for AN24 and B737. B737s fitted with a gravel kit are designed to operate on unsealed runways.
b) MCAT might consider issuing a dispensation for B727 operations if requested.
c) If dust is a major problem, runway sealing (at additional cost) might be necessary.

3.5.4. Mazar-i-Sharif

Existing Conditions

Runway and Strip

Mazar-i-Sharif airport has a single asphalt runway 3,200 metres long by 45 metres wide on an alignment of 06/24. The runway surface is in poor condition with loss of aggregate from the asphalt and longitudinal cracks generally along construction joins. Shape is good (central crown) and riding quality is reasonable. Considerable bomb damage to the runway has been mostly repaired and work was being carried out towards the northern end at the time of visiting. A significant depression still exists approximately 450 m from the 06 (western) end and is a potential hazard to aircraft taking off on runway 06.

A parallel taxiway runs from the apron to the end of runway 06. This is asphalt and in similar condition to the runway.

There are no markings delineating the extent of the runway strip which appears to be 90 metres wide. A 150 metre wide strip is obtainable on the site. The strip is relatively well graded and well grassed. Grass was noted up to 450 mm high. Overall strip drainage appears to be satisfactory but runway edge drainage is impeded by a build-up of silt and grass which should be graded off. A single wind indicator is located south of the apron.

There appear to be no obstructions in the approach/takeoff areas for at least 5 km in both directions. The 1 in 7 transitional surfaces are partially obstructed by wrecked vehicles and aeroplanes, a number of structures close to the runway, and a stack of containers near the military compound north of the apron.

Terminal and Apron

The asphalt apron and single taxiway to the runway are in similar condition as the runway. Whilst useable by aircraft up to B727, the surface is in urgent need of an overlay. The standard concrete and brick terminal with control tower on top looks to be in reasonable condition from the airside but was not inspected due to lack of time.

A large single storied building adjacent to the terminal is being used by Ariana. It was probably the former fire station, power house and storage building. This appears to be generally in poor condition and currently provides none of its former functions.

Control Tower, Communications, Navigation Aids and Operational Facilities

There are no navigation aids, airport lighting or aircraft refuelling facilities at Mazar-i-Sharif airport. The former fire service is defunct due to lack of fire vehicles and fire station.

Recommended Development

Summary

Mazar-i-Sharif airport should be restored and upgraded for B727/B737 type aircraft, including night operations, based on retaining the existing runway length. This will involve an asphalt runway overlay to restore shape and riding quality, asphalt overlay to the taxiways and apron, provision of a 150 m wide runway strip, a new terminal building, and appropriate operational facilities.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and pavement evaluation/testing for overlay design
- preparation of airport development plan and design plans
- revision of AIP data, approach and departure procedures and other AIS documents
- remove war wreckage
- new passenger terminal
- reconstruct access road and car park
- water supply and sewerage
- apron security fencing and gates
- rehabilitate runway strip and widen to 150 m, including drainage as required and remove obstructions
- asphalt overlay to runway (3,200 x 45), taxiways and apron including regulation course to restore shape
- pavement markings (runway, taxiway and apron) and visual aids
- wind indicators
- airport lighting system including PAPI
- powerhouse and generators

- new meteorological office and equipment
- reconstruct boundary fence
- airport maintenance facilities and equipment

Stage 2

- new control tower and operations/communications building including full equipment
- new fire station and equipment
- fire tenders
- NDB
- co-located VOR/DME

3.5.5. Kunduz

Existing Conditions

Runway and Strip

Kunduz airport has a single asphalt runway 2,000 metres long by 45 metres wide on an alignment of 11/29.

The runway surface is in reasonable condition and gives a relatively smooth ride for aeroplanes. There is a thin asphalt overlay approximately 10 years old on the central 15 metres and bomb craters have been recently repaired with concrete. There are some basic non-standard runway centreline markings but no runway identification numbers. A serviceable wind indicator is located adjacent to the apron.

There are no markings delineating the runway strip which appears to be graded to approximately 90 metres wide. The strip is overgrown with long grass and there are numerous obstructions including heaps of stones and boulders, structures, wrecked aeroplanes and vehicles and earth mounds. Drainage appears to be satisfactory (apart from the apron area). The 1 in 7 transitional surfaces are partly obstructed by structures, aircraft wreckage and large steel posts which are all that remain of the boundary fence. All obstructions should be cleared as soon as possible.

Terminal and Apron

The apron and single taxiway are asphalt which is very old. The surface is badly cracked and ravelling (losing stone) extensively. Nevertheless, it is still functional and shows no signs of failure due to overloading. Recent repairs to fill in bomb craters are evident on the taxiway and apron. Levels on the apron vary considerably, partly due to bomb damage, and there are extensive low areas which pond water.

The single storey concrete and brick terminal with control tower cab on top appears to be in reasonable condition and had been painted recently outside.

There is a large building adjacent to the terminal which was probably the former fire station and storage building. This is in poor condition and provides none of its former functions. There is a large unpaved car park between the back of the terminal and the main road and a number of other buildings, most in rundown condition.

Control Tower, Communications, Navigation Aids and Operational Facilities

The control tower is not in use but appears intact and has glass in the windows.

There are no navigation aids or airport lighting facilities. The former fire service is defunct due to lack of fire vehicles and fire station.

Recommended Development

Summary

It is considered that Kunduz airport should be restored and upgraded for regular services by AN24 type aircraft, including night operations, based on retaining the existing runway length. This will involve an asphalt overlay to restore shape and riding quality to the runway, taxiway and apron, provision of a 150 m wide runway strip, and refurbishment of the passenger terminal, control tower and operational facilities. Whether or not provision of a fire service would be justified on the basis of traffic levels would need to be decided by MCAT. The airport (apart from terminal facilities) would also be suitable for occasional B737 and B727 use.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and pavement evaluation/testing for overlay design
- preparation of airport development plan and design plans
- revision of AIP data, approach and departure procedures and other AIS documents
- refurbish passenger terminal
- reconstruct and seal access road and car park
- water supply and sewerage
- apron security fencing and gates
- clear all aircraft wreckage and other debris from the airport property
- rehabilitate runway strip and widen to 150 m, including drainage as required

- asphalt overlay to existing runway (2,000 m by 45 m), taxiway and apron including regulation course to restore shape
- pavement markings (runway, taxiway and apron) and visual aids
- wind indicators
- airport lighting system including PAPI
- reconstruct boundary fence clear of 1 in 7's
- refurbish control tower and operations/communications office including full equipment
- new meteorological office and equipment
- powerhouse and generators
- airport maintenance facilities and equipment

Stage 2

- refurbish fire station and re-equip (if required by MCAT)
- fire tender (if required by MCAT)
- NDB
- co-located VOR/DME

3.5.6. Herat

Existing Conditions

Runway and Strip

Herat airport has a single asphalt runway 2,500 metres long by 45 metres wide on an alignment of 01/19. The runway surface is in poor condition. Constructed with a central crown, there is some loss of shape and significant cracking of the asphalt, although little loss of stone.

Currently a central strip of hand placed asphalt approximately 20 metres wide and 10 mm thick is being placed full length of the runway to improve riding quality and protect the pavement from water ingress. Riding quality of the runway is reasonable but far from smooth.

There are no runway markings or identification numbers and there is a considerable amount of rubber on the surface for approximately 1,000 metres at the south end, indicating an unstable approach to runway 01 (the preferred direction for landing) due to lack of slope guidance.

There are no markings delineating the extent of the runway strip which appears to be 90 metres wide. The strip is relatively well graded with some rocks and sparse vegetation up to 1 metre high. Drainage appears to be satisfactory. A single wind indicator is located south of the apron.

There are no close-in obstructions for takeoff to the south (runway 19) and flat land in this direction lends itself to a future runway extension if required. The takeoff area to the north (runway 01) is obstructed by village houses approximately 300 to 500 metres from the runway end and some trees. Although stopways are noted in AIP (December 1990) they are rough and unusable and require reconstruction.

Terminal and Apron

The apron and single taxiway are in similar condition as the runway. The southern half of the apron is used by the military. The airside façade of the large concrete and brick terminal with control tower on top is well maintained but the building is in poor condition inside.

A well appointed VIP room is located next to the terminal. It was formerly the communications office. Next to the VIP room is the former fire station, power house and storage building. This is in poor condition and currently provides none of its former functions.

Control Tower, Communications, Navigation Aids and Operational Facilities

The control tower cab appears to be in good condition structurally but is reached by a very steep staircase with no safety rails. There is no heating or cooling in the cab or proper equipment of any kind.

There are no navigation aids or airport lighting facilities at Herat airport. The former fire service is defunct due to lack of fire vehicles and fire station. There are three diesel generator sets in the powerhouse, one of which is said to be in working order but lacking a battery for starting. All are original American units rated at 15-17 KVA each and could probably all be restored to working condition relatively easily. There was an aircraft fuel depot but this has been destroyed.

Recommended Development

Summary

Herat airport should be restored and upgraded for B727/B737 type aircraft, including night operations, based on retaining the existing runway length. This will involve an asphalt runway overlay to restore shape and riding quality, reconstruction and sealing of the 200 m long stopways at each end, provision of a 150 m wide runway strip, and a new terminal area including apron, taxiway, passenger terminal, and operational facilities. The existing apron is too close to the runway if a 150 m wide strip is introduced.

The runway can be extended to the south if required in the future. Diversion of the Kandahar road could be necessary, depending on the length of the extension.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and pavement evaluation/testing for overlay design
- preparation of airport development plan and design plans
- revision of AIP data, approach and departure procedures and other AIS documents
- new passenger terminal, access road and car park
- water supply and sewerage for new terminal area

- apron security fencing and gates
- new apron and taxiway
- rehabilitate runway strip and widen to 150 m, including drainage as required
- asphalt overlay to runway including regulation course to restore shape (2,500 m by 45 m)
- pavement markings (runway, taxiway and apron) and visual aids
- wind indicators
- reconstruct and seal 200 m by 45 m stopways at each end
- airport lighting system including PAPI
- reconstruct boundary fence
- new control tower and operations/communications building including full equipment
- new meteorological office and equipment
- powerhouse and generators (or refurbish existing generators)
- airport maintenance facilities and equipment

Stage 2

- new fire station and equipment
- fire tenders
- NDB
- co-located VOR/DME

3.5.7. Jalalabad

Existing Conditions

Runway and Strip

Jalalabad airport has a single asphalt runway 2,200 metres long by 45 metres wide on an alignment of 13/31. The runway surface is generally in poor condition. There is a 16 m wide central overlay of newer asphalt which is sound but very undulating. The rideability was judged as rough in a pickup truck at high speed and the surface is considered marginal for aircraft operations. Departure from the centre section could be a potential hazard to aircraft landing or taking off as there is a drop-off between 15 and 50 mm on the edges of the overlay. There are some basic non-standard runway centreline markings but no runway identification numbers. No wind indicator was noted.

There are no markings delineating the runway strip which appears to be graded to approximately 90 metres wide. The strip is overgrown with vegetation up to 1.5 metres high. Strip obstructions include stone and boulders, various buildings, wrecked vehicles and aeroplanes and substantial earth mounds. At the southern end, there is a sharp drop off to a watercourse within the strip width. Drainage appears to be satisfactory. The 1 in 7 transitional surfaces and the take off and approach areas are also partly obstructed by trees and wreckage. All obstructions should be cleared as soon as possible.

Stopways approximately 200 m long have been recently constructed at both ends of the runway. They are very rough due to the large size of stone, and require a smooth surface course of crushed rock or asphalt to be useable.

Terminal and Apron

The apron and single taxiway received a thick asphalt overlay about 10 years ago and are in similar condition to the runway. The surface is rough and undulating and does not drain well. The concrete and brick terminal with control tower cab on top is in poor condition and is currently occupied by the military.

The former fire station and storage building adjacent to the terminal is in poor condition and provides none of its former functions. There is a large unpaved car park between the back of the terminal and the main road and a number of other buildings, most in rundown condition.

Control Tower, Communications, Navigation Aids and Operational Facilities

The control tower is not in use and has no glass in the windows. It is understood that MCAT does not presently provide any air traffic services at Jalalabad and VHF communications are operated by the military.

There are no navigation aids or airport lighting facilities. The former fire service is defunct due to lack of fire vehicles and fire station. There was an aircraft fuel depot but this is not currently functional.

Possibility of Alternate Airport for Kabul

Jalalabad airport has been proposed by ICAO[9] as a possible alternate airport for Kabul if there was bad weather at Kabul or a disabled aircraft was blocking the single runway at Kabul. In the latter case, there is concern that if Kabul airport was closed for a considerable time, particularly during the current emergency, that urgently needed supplies might be prevented from being landed at Kabul. If Jalalabad was available as an alternate airport, aircraft could be diverted there and cargoes could be trucked the reasonably short distance from Jalalabad.

The consultants consider there is insufficient justification for the major capital expense involved in upgrading Jalalabad to a standard sufficient to enable operations by large heavy lift aircraft on an alternate basis, particularly as normal traffic levels at Jalalabad are expected to be moderate, supporting only regular AN24 services. The upgrading works recommended in this report would enable aircraft up to A300 and B767 size to use the airport in an emergency. Kandahar airport (when available) could readily serve as a bad weather alternate to Kabul for larger aircraft and, when the Kabul – Kandahar road is restored, would be within 6 hours from Kabul by road. The specific problem of a disabled aircraft at Kabul might be alternatively addressed by provision of a second or emergency runway at Kabul and by putting in place arrangements for the rapid deployment of suitable equipment for disabled aircraft removal.

Recommended Development

Summary

It is understood that in the past, Ariana operated B727 aircraft to Jalalabad airport. However, due to the reasonably close distance to Kabul and the planned improvements to the Kabul - Jalalabad road, it is likely that future demand will not support this level of service.

Therefore, it is considered that Jalalabad airport should be restored and upgraded for regular services by AN24 type aircraft, including night operations, based on retaining the existing runway length. This will involve an

[9] ICAO, June 2002

asphalt overlay to restore shape and riding quality to the runway, taxiway and apron, sealing of the 200 m long stopways at each end, clearing and regrading of the runway strip and extension to 150 m wide, renovation of the existing passenger terminal, control tower and fire station and provision of appropriate operational facilities. The airport (apart from terminal facilities) would also be suitable for B737 and B727 use.

The runway could possibly be extended at the northern end (i.e. towards Jalalabad city), if required in the future. However, this would need to be confirmed by a full engineering and feasibility study.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and pavement evaluation/testing for overlay design
- preparation of airport development plan and design plans
- revision of AIP data, approach and departure procedures and other AIS documents
- removal of all war wreckage
- renovate and improve passenger terminal
- new meteorological office and equipment
- reconstruct access road and car park
- water supply and sewerage
- apron security fencing and gates
- rehabilitate runway strip and widen to 150 m, including drainage as required
- asphalt overlay to existing runway (2,200 m by 45 m), taxiway and apron including regulation course to restore shape
- pavement markings (runway, taxiway and apron) and visual aids
- wind indicators
- surface and seal 200 m by 45 m stopways at each end

- airport lighting system including PAPI
- standby powerhouse and generators
- reconstruct boundary fence
- airport maintenance facilities and equipment

Stage 2

- renovate control tower, provide appropriate space for operations/communications in existing terminal building and full equipment
- renovate fire station and re-equip if required by MCAT
- fire tender if required by MCAT
- NDB if required by MCAT
- co-located VOR/DME if required by MCAT

3.5.8. Faizabad

Existing Conditions

Runway and Strip

Faizabad airport has a single runway 2,000 metres long by approximately 34 metres wide on an alignment of 18/36. The site was established by the Russian military as a tactical airfield and the runway is paved with interlocking steel panels which give a very rough ride to light aircraft, especially when taxiing.

The steel surface is in good condition and is maintained by a local team to ensure the panels stay locked together and there are no dangerous edges sticking up. There are no runway centreline markings or runway identification numbers. The runway is low lying and cross section shape varies from dished in the middle (near the apron) to one way cross fall. Drainage problems in the wet have been noted in other inspection reports.

A serviceable wind indicator is located opposite the apron.

There is no runway strip. The area opposite the apron is undulating ground up to 2m above runway level within 5m to 10m of the runway edge. All of the terrain surrounding the runway is littered with stones, large boulders and other debris which extends right up to the runway edge.

The notional 1 in 7 transitional surfaces are partly obstructed by structures and aircraft parked on the apron.

Terminal and Apron

The apron and single taxiway are concrete. The taxiway is of fairly new construction and in good condition, the design aircraft is not known. The edge of the apron is only 17 m from the edge of the runway. The northern half of the apron is in good condition and is preferred for aircraft parking; the southern half is badly cracked and in derelict condition.

There are a number of derelict buildings in the apron area and the police station which is habitable. There are no buildings or facilities for passengers or airline operators.

Control Tower, Communications, Navigation Aids and Operational Facilities

There are no ATC, communications, navigation aids or airport lighting facilities. The shell of the former control tower is located some 200 m north of the apron.

It is considered that air traffic control services and rescue fire fighting facilities are not justified at Faizabad due to the low level of traffic.

Recommended Development

Summary

Faizabad is an important regional centre for Badakhshan. It will probably become a hub for small aircraft providing services to remote locations such as Darwaz, Sheghnan and Khwahan, albeit, in competition with Kunduz. The area also has a very high tourist potential.

It is considered that Faizabad airport should be developed for regular services by AN24 type aircraft in daylight visual meteorological conditions based on retaining the existing runway length and location. This will involve removal of the steel surfacing on the runway, provision of an 80 m wide graded runway strip, relocation of the terminal area, (i.e. taxiway and apron) to meet strip clearance requirements, provision of a passenger terminal and associated facilities. Location of the new terminal close to the southern end could be considered, where it is closer to Faizabad town and would minimise taxi distance with the preferred landing on runway 18 and takeoff on runway 36.

Alternatively, it may be possible to construct a new runway of similar length in a slightly different position, thereby enabling the existing runway to be kept in operation during the construction period. More detailed investigation is required to determine the feasibility of runway reconstruction vs runway relocation.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and materials evaluation/testing for pavement design
- investigation of alternative runway/airport locations
- preparation of airport development plan and design plans

- revision of AIP data, approach and departure procedures and other AIS documents
- passenger terminal
- meteorological office and equipment
- access road and car park
- water supply and sewerage
- apron security fencing and gates
- construct runway strip 80 m wide, including drainage as required
- construct runway (2,000 m by 30 m), new taxiway and new apron (asphalt)
- pavement markings (runway, taxiway and apron), strip markers and wind indicators
- construct boundary fence
- airport maintenance facilities and equipment

Stage 2

- powerhouse and generator
- NDB

3.5.9. Bamyan

Existing Conditions

Runway and Strip

Bamyan airport has a single gravel runway 2,590 metres long by approximately 23 metres wide within a graded strip approximately 40 m wide. The alignment is 06/24. The original runway was approximately 1,500 m long and was extended some 10 years ago for military purposes. The runway is unusual in that there is a noticeable kink of about 10 degrees where the extension meets the original, due to the proximity of the river at the north western end. This does not seem to be a problem to operations.

The brown gravel surface is in good condition and is maintained (including snow clearing) by a local team under direction of an NGO. It is generally well compacted in the central 23 m section and the landing and takeoff runs were quite smooth.

Gravel size is up to 75 mm maximum dimension of stone, which is considered rather large for an airfield but pilots reported they do not experience much significant propeller or body damage from stones. However, PACTEC will be constructing a concrete pad for parking and engine run up in the near future.

White painted concrete markers set flush into the surface designate the runway edges and runway “24” but are difficult to distinguish from the surrounding gravel.

A small gravel apron is located near the north eastern end of the runway, on an area of fill. A serviceable wind indicator is located at the runway 24 threshold.

The runway strip is constructed on a side cut into the hill which slopes from south to north and there is a significant vertical bank up to 2 m high along 50% of the southern edge. A large ravine is crossed about half way along the runway where the strip width narrows to approximately 40 m and there is a large drop off on both sides.

The notional 1 in 7 transitional surfaces are obstructed by the earth banks on the south side of the runway, aircraft parked on the apron and a number of local houses at the western end which have been built almost to the runway edge.

Terminal and Apron

The apron is contiguous with the strip and there is no taxiway. There are no buildings or facilities for passengers or airline operators and vehicles drive right up to the aircraft. There is no other parking area and the road to town leads directly north from the apron. The apron can be readily extended by filling up to 2 to 3 metres deep. This will enable aircraft to park clear of the 1 in 7 transitional surfaces and provide space for a car park and terminal.

Control Tower, Communications, Navigation Aids and Operational Facilities

There are no ATC, communications, navigation aids or airport lighting facilities.

It is considered that air traffic control services and rescue fire fighting facilities are not justified at Bamyan due to the low level of traffic.

Recommended Development

Summary

Bamyan is an important regional centre for the Hazara. The area also has a very high tourist potential. It is situated in very mountainous terrain and the approach and takeoff procedures are difficult in marginal weather.

It is considered that Bamyan airport should be developed for regular services by Twin Otter and other aircraft up to around 20 seat capacity, in daylight visual meteorological conditions. AN24 operations might be possible in certain conditions but would require an operational assessment and published procedures.

The AN24 would probably require around 2,000 metres of runway allowing for altitude and a take off weight less than maximum due to low fuel requirements. Whether or not to retain and maintain the full 2590 m would depend on the viability of AN24 operations and any other critical aircraft which operators might propose, and any future military requirements.

Upgrading of Bamyan airport for Twin Otter/AN24 would involve provision of an 80 m wide graded runway strip, apron extension to meet strip clearance requirements, provision of a passenger terminal, car park and associated facilities. Consideration should also be given to sealing the runway, taxiway and apron to reduce future maintenance and improve the surface texture.

More detailed investigation is required to determine the optimum runway length which should be retained and therefore, whether or not the houses at the western end of the strip will need to be removed.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and materials evaluation/testing for pavement design
- preparation of airport development plan and design plans
- revision of AIP data, approach and departure procedures and other AIS documents
- extend taxiway and apron (asphalt)
- passenger terminal
- meteorological office and equipment
- access road and car park
- apron security fencing and gates
- establish runway strip 80 m wide, including drainage as required (grade out earth banks to comply with 1 in 7s, widen strip over ravine, remove houses at western end)
- airport markers (runway, strip, taxiway and apron) and wind indicators
- airport maintenance facilities and equipment

Stage 2

- construct boundary fence
- water supply and sewerage
- powerhouse and generator
- NDB
- resheet and seal runway (2,000 x 30)
- paint runway markings

3.5.10. Chaghcharan

Existing Conditions

Runway and Strip

Chaghcharan airport has a single gravel runway 1,950 metres long by approximately 21 metres wide within a graded strip approximately 35 m wide. The alignment is 07/25. It is located on a large expanse of flat land within a bend in the river and the threshold at either end is close to the river bank. Chaghcharan township is immediately across the river at the western end.

The gravel surface is in good condition but bumpy in places. Composed of fine brown gravel, maximum dimension approximately 15 mm, it is generally well compacted in the central 21 m section and the landing and takeoff runs were reasonably smooth. The cross sectional shape is very flat, and it is understood the surface becomes soft in wet weather.

The graded strip out to 35 m was in good condition and clear of vegetation apart from small weeds. Longitudinal drains are located at the edge of the 35 graded strip for most of the runway length. There is no graded or prepared surface outside the 35 m strip but a 90 m wide strip could be easily obtained and a 150 m strip might be possible without relocation of the terminal building. However, it is understood there are extensive mine fields around this airport which would need to be cleared before strip widening would be possible.

Strip maintenance (including snow clearing) is carried out by a local team funded by UNOPS. One serviceable diesel roller was noted on the apron.

There are no obstructions to the approach and takeoff areas and notional 1 in 7 transitional surfaces apart from a number of buildings in the town at the western end. Rising ground behind the town could obstruct the takeoff surface at this end (takeoff runway 25).

Terminal and Apron

The large gravel apron is located near the western end of the runway and is in good condition. There are several aircraft wrecks in the apron area. If required, the apron area could be extended.

The former terminal building is in reasonable condition but is not in use. An adjacent building is being used as a residence.

A serviceable wind indicator is located across the runway from the apron.

Control Tower, Communications, Navigation Aids and Operational Facilities

There are no ATC, communications, navigation aids or airport lighting facilities.

Recommended Development

Summary

It is considered that Chaghcharan airport should be upgraded for AN24 operations in daylight visual meteorological conditions, although it is likely that smaller aircraft will provide the majority of services due to the low traffic demand.

The major work is to resheet the runway and provide a central crown to obtain all weather capability and to establish an 80 m wide runway strip.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and materials evaluation/testing for pavement design
- preparation of airport development plan and design plans
- revision of AIP data, approach and departure procedures and other AIS documents
- remove aircraft wreckage and other rubbish from airport property
- renovate passenger terminal
- meteorological office and equipment
- apron security fencing and gates
- resheet runway (1,950 x 30), taxiway and apron with gravel to provide a central crown with maximum transverse slope of 1.5%
- clear mines and UXO from airport
- establish runway strip 80 m wide, including drainage as required
- airport markings (runway, strip, taxiway and apron) and wind indicators

- airport maintenance facilities and equipment

Stage 2

- construct boundary fence
- water supply and sewerage
- NDB if required by MCAT
- powerhouse and generator

3.5.11. Lal

Lal airport was inspected from the air during two low level passes. The existing strip is natural surface, 700 metres long by approximately 30 metres wide on a bearing of 07/25. The strip is located between the river and the road in a narrow valley approximately 2 km NE of the town.

Work is currently under way to extend the strip to 1,400 metres which involves crossing a large ravine. Construction is being carried out by local people under UNOPS intensive labour program.

3.5.12. Yakawlang

Existing Conditions

Runway and Strip

Yakawlang airport is located on a high flat plateau devoid of vegetation, above the river valley. The natural surface runway 1,700 metres long by approximately 30 metres has a thin layer of gravel and is marked by orange painted stones. The alignment is 03/21 and there is a 2% slope up from south to north. Yakawlang township is some 30 minutes by vehicle from the airstrip.

The runway surface is in generally good condition but rough in places. The cross sectional shape is very flat, and the surface becomes soft and boggy in wet weather.

There is no marked strip but due to the flat terrain, the natural surface provides a reasonable strip to at least 90 m width, the only obstructions being the stones marking the runway edges. There is a steep drop off into a gully some 30 m from the southern end.

Strip maintenance (including snow clearing) is carried out by a local team supported by the UNOPS intensive labour program.

There are no close in obstructions to the approach and takeoff areas and notional 1 in 7 transitional surfaces but the site is surrounded by hills and more distant high mountains.

Terminal and Apron

There is no terminal shelter or apron and aircraft park on the end of the runway. PACTEC will shortly be constructing a small concrete parking and run up pad at the southern end. The airport is seldom used by more than one aircraft at a time.

Control Tower, Communications, Navigation Aids and Operational Facilities

There are no ATC, communications, navigation aids or airport lighting facilities. There is no wind indicator.

Recommended Development

Summary

It is considered that Yakawlang airport should be upgraded for AN24 operations in daylight visual meteorological conditions, although it is likely that smaller aircraft will provide the majority of services due to the low traffic demand.

The major work is to resheet the runway and provide a central crown to obtain all weather capability.

Scope of Works

The proposed scope of works for the rehabilitation project is listed below.

Stage 1

- aerodrome topographical survey and approaches survey, preparation of aerodrome plan (physical), runway levels (cross sections and longitudinal sections) and materials evaluation/testing for pavement design
- preparation of airport development plan and design plans
- revision of AIP data, approach and departure procedures and other AIS documents
- resheet runway (1,700 x 30) with gravel to provide a central crown and maximum transverse slope of 1.5% for drainage
- construct sealed taxiway and apron
- terminal shelter including meteorological office and equipment
- establish runway strip 80 m wide, including drainage as required
- airport markings (runway, strip, taxiway and apron) and wind indicators
- airport maintenance facilities and equipment

Stage 2

- NDB if required by MCAT
- powerhouse and generator

3.5.13. Maymana

Maymana was not visited by the consultants. From the available information it is likely that Maymana should be upgraded for AN24 operations in daylight visual meteorological conditions. This report is, however, unable to define the scope of works or likely costs.

3.6. Airport Operations and Maintenance

3.6.1. Immediate Needs

Very few airport maintenance tasks are being carried out at major domestic and regional airports at the present time. Those that are being performed are generally done on an ad-hoc basis by NGOs, contractors or UN agencies, often in the absence of engineering design and specifications or supervision. As far as the TSR team is aware there is no organised airport maintenance organisation or personnel within either the MCAT or MPW, and there are no experienced personnel on site who can carry out basic strip maintenance or give safety reports to aircraft operators or pilots intending to land.

The immediate needs are listed in the following table.

No.	*Task*	*Comments*
1.	Recruit and train airport maintenance personnel. Training will include both theoretical and practical activities.	By MCAT or nominated agency.
2.	Recruit experienced trainers	
3.	Prepare training material and course curriculae	
4.	Prepare “Airport Maintenance Manual” for major domestic airports	For guidance of airport maintenance staff
5.	Prepare “Airport Maintenance Manual” for small airports	For guidance of airport maintenance officer
6.	Prepare “Specification for Airport Works”	“How to” – defines the required standards for works
7.	Prepare “Reporting Officer’s Handbook”	Defines safety items to inspect and how to report to pilots, etc.
8.	Appoint airport maintenance personnel to each airport	Small airports will just have an Airport Maintenance Officer.
9.	Appoint Airport Reporting Officers at small airstrips.	The Airport Maintenance Officer may also double as the Airport Reporting Officer. Appropriate communications equipment is required.
10.	Conduct training courses for Airport Reporting Officers	
11.	Provide appropriate maintenance facilities and equipment at each airport.	A secure building to keep and maintain equipment is required at each airport.

No.	*Task*	*Comments*
12.	Provide appropriate guaranteed funding arrangements for airport maintenance and reporting.	Could be from MCAT, airport authority or airport company(ies) (when created), or other agency responsible for airport maintenance.
13.	Establish an airport inspectorate in MCAT Safety and Licensing Division and train airport inspectors.	

3.6.2. Implementation of Airport Maintenance

Once the initial graduates from the airport maintenance training courses are placed in the field and requisite equipment and facilities are available on site, organised airport maintenance can commence. Typical airport operation and maintenance tasks for major domestic and regional/sub-regional airports are listed in the following table, together with a recommendation of the responsible agency, which could be, for example, a central HQ (MCAT or an airport company), the local airport (which might be managed by a subsidiary company or a provincial authority, etc.), or the airline agent.

PROPOSED ALLOCATION OF OPERATION AND MAINTENANCE TASKS FOR AIRPORTS IN AFGHANISTAN (EXCLUDING KABUL AND KANDAHAR)

Task	*Management by*
Management of airport system	HQ
Management of terminal and other buildings	Local Airport
Cleaning of terminal and other buildings	Contractor
Flight service – e.g. weather, runway condition and preferred landing direction (if provided)	Local Airport or airline agent
Check in, ticketing, cargo handling and passenger service	Airline agent
Baggage handling	Airline agent or Local Airport
Rescue fire service (if provided)	HQ, Local Airport or contractor
Maintenance of pavements (runway, taxiways, apron), remove stones and foreign objects from pavements, pavement markings, drains, etc. Carry out repairs, repaint markings as required.	Airport maintenance staff or contractor
Snow clearing	Airport maintenance staff or contractor

Task	***Management by***
Maintenance of runway strip (cut grass, remove stones, keep drainage system operational, strip markers, wind indicators, unserviceability markings, etc)	Airport maintenance staff or contractor
Maintenance of obstacle limitation surfaces (approach and takeoff fans, transitional surfaces)	Airport maintenance staff or contractor
Maintenance of buildings, roads, car parks, fences, street lights	Airport maintenance staff or contractor
Maintenance of airport lighting including apron floodlights (if provided)	Airport maintenance staff or contractor
Maintenance of communications equipment (if provided)	Contractor
Maintenance of standby generator and electrical reticulation system	Contractor
Maintenance of sewerage system, potable water supply system, storm water drainage system, toilets, etc	Contractor
Maintenance of airport maintenance plant and equipment, e.g. trucks, tractors, rollers, mowers, slashers, hand tools, etc	Contractor
Maintenance of airport vehicles including cars, buses and fire trucks (if provided)	Contractor
All items related to safety to be audited twice per year by the Airports and Airways Inspectorates under the terms of the airport licence issued by the Safety and Licensing Division.	
Note: The CNS/ATM service provider will install and maintain any navigation aids and also provide air traffic control services if required (i.e. equipment, facilities and staff).	

3.6.3. Airport Maintenance Standards and Inspections

No airports in the country comply fully with Annex 14 requirements and some are deficient in significant areas, such as runway strip width, runway surface quality, and obstacles on the strip and in the clearance surfaces. None of these deficiencies are documented in the AIP[10] or NOTAMS and it is not clear to the consultants whether or not MCAT has issued appropriate operational dispensations[11] to the respective aircraft operators.

Due to the current staffing situation, regular airport inspections to check compliance with operational standards are not routinely carried out. A formal program needs to be set up for regular, detailed inspection and reporting of airport facilities and condition, in particular, the runway and strip surface condition and obstacle limitation surfaces. In the interim, inspections could be carried out on behalf of MCAT by an experienced consultant.

Airport Maintenance Standards will be set by the Airports Inspectorate. They will be set out and explained in simple terms in the “Airport Maintenance Manual” and the “Reporting Officer’s Handbook” (Refer to the previous section).

Airport Inspectors should travel to each airport twice per year to check that airports are being maintained in accordance with the standards and will be empowered to order the responsible authority to carry out corrective works as necessary. The Airport Inspectors’ training and experience will also enable them to advise and assist the Maintenance Officers and Reporting Officers on problems with reporting, procurement, pavements, drainage and other items.

Training courses should be provided at suitable intervals by the CATC for Airport Inspectors, Airport Maintenance Officers and Airport Reporting Officers to revise and improve their skills and to train new recruits.

[10] Last issued December 1990.

[11] A dispensation should define the conditions under which operations may be conducted at airports which do not meet prescribed standards but maintain equivalent levels of safety. Such a dispensation may be necessary to permit operations by aircraft which would otherwise be excluded from operating at the airport, or penalised to the extent that the operation would be uneconomic.

3.6.4. Airport Maintenance Costs

Airport maintenance costs can vary widely depending on the size of the airport, the standard of maintenance which is carried out and the lifecycle of the assets. New runways or terminal buildings for example will require little maintenance for the first few years but then a gradually increasing effort will be necessary as normal wear and tear and the forces of nature play their part. Whether maintenance is done by day labour or under contract is also a factor in the cost.

Maintenance is normally classified for operational and funding purposes as being either regular or periodic as indicated below:

- day to day or regular maintenance covers such items as runway sweeping, grass mowing, gardening, drain cleaning, minor pavement repairs (e.g. patching and crack sealing), terminal cleaning, snow clearing, and the like
- cyclical or periodic maintenance includes repainting of pavement markings, rubber removal, and reseal or overlay of runways, taxiways and aprons. (Typically, pavement markings need to be repainted every 3 to 5 years and reseals/overlays will be required every 7 to 12 years)

Usually, an annual allocation will be made for regular maintenance and periodic maintenance items will be programmed for budgeting purposes. The maintenance program should be reviewed periodically to ensure that projects are not implemented too early or too late.

Typical cost components of regular maintenance are labour, plant (cost of hire, replacement and maintenance), fuel and materials. Periodic maintenance projects would normally be carried out under contract and typical cost components in addition to the contract itself include design and supervision, and allowances for contingencies and cost escalation.

Based on the above, the consultants estimates for regular maintenance at the airports which were inspected, following completion of the recommended upgrading works, are given in the following table.

Airport	***Annual maintenance cost (USD)***	***Remarks***
Mazar-I-Sharif	$170,000	Paved runway, taxiways and apron, airport lighting
Kunduz	$135,000	Paved runway, taxiway and apron, airport lighting
Herat	$135,000	Paved runway, taxiway and apron, airport lighting

Airport	***Annual maintenance cost (USD)***	***Remarks***
Jalalabad	$135,000	Paved runway, taxiway and apron, airport lighting
Faizabad	$80,000	Paved runway, taxiway and apron
Bamyan	$95,000	Paved runway, taxiway and apron
Chaghcharan	$70,000	Gravel runway, taxiway and apron
Yakawlang	$55,000	Gravel runway, taxiways and apron
Sub Total	$875,000	
Overheads	$125,000	(Allow 15%)
TOTAL	**$1,000,000**	

3.7. Implementation

3.7.1. Airport Upgrading

The recommended implementation for airport upgrading projects is outlined below.

1. **Identification and acceptance of donor offers for project funding.** This will probably be an ongoing process and would be managed by the project manager when it is appointed.

2. **Appointment of a project manager** (company). The project manager will be responsible for detailed investigation, design and documentation, tendering, contract administration and coordination of all projects[12]. The project manager would be selected jointly by MCAT and the funding agency after an international tender. It is envisaged that this process would take approximately 6 to 12 months before the project manager is mobilised in Afghanistan.

3. **Investigation / Design and documentation**. This would take approximately 6 months before the first project (or project package) is ready for tendering, and would continue until all projects have been documented.

4. **Tendering**. Major projects would be put out to international tender. The process would take between 6 to 9 months to finalise contract documents and mobilise the contractor on site.

5. **Construction**. All projects are relatively small and none would take more than 6 months to complete assuming material supplies are readily available and there are no unexpected difficulties. Due allowance will have to be made in the construction programs for winter conditions.

Airports not covered in this report and for which there is no recommended development program will need to be surveyed and projects developed where required which would then be implemented in the same way.

[12] There would be advantages and cost savings if a single project manager was appointed for CNS/ATM implementation and the airport upgrading progam.

3.7.2. Documentation for Airport Management

A considerable amount of documentation is required for airport management, maintenance and training purposes. A concerted program will be required to produce this documentation in step with personnel training needs and operational needs.

A tentative documentation program is given below. Donor funding would be required to support the program.

Document	***Estimated input (man-months)***	***Indicative cost[13] (USD)***
Airport Maintenance Manual for small airports	.5	10,000
Airport Maintenance Manual for large airports	1	20,000
Reporting Officer's Handbook	.5	10,000
Airport Management Manual for small airports	.5	10,000
Airport Management Manual for large airports	1	20,000
AIP-AGA[14] Update	1.5	30,000
Course Syllabuses	1.5	30,000
Course Notes	1	20,000
TOTAL		**150,000**

[13] Based on USD20,000 per month for a technical expert.

[14] Aeronautical Information Publication – Aerodromes and Ground Aids

3.7.3. Training

An outline training program is given below.

Course	*Description*	*Who should attend*	*Length[15] (days)*
Airport Safety	Principles of safety on airports particularly related to airside	All personnel who will be working on airports	1
Airport Management 1	Basic principles of airport management for small airports	All airport managers and prospective managers	2
Airport Management 2	Advanced management concepts and techniques for major airports	All managers and prospective managers of major airports	3
Airport Maintenance 1	Basic principles of airport maintenance for small airports. Will include practical demonstrations and hands on experience.	All Airport Maintenance Officers	3
Airport Maintenance 2	Advanced maintenance concepts and techniques for major airports. Will include practical demonstrations and hands on experience.	All Airport Maintenance Officers and prospective AMO's for major airports	5
Aerodrome Reporting Officer	Basic airstrip inspection techniques, basic meteorology related to aircraft operations, reporting, radio technique	All Aerodrome Reporting Officers and all AMO's at regional and minor airports	2

[15] Full time

Course	***Description***	***Who should attend***	***Length[15] (days)***
Airport Inspector 1	Responsibilities relating to airport licences, aircraft operating concepts, basic airstrip inspection and maintenance techniques, basic pavement design, radio technique, airfield safety	All Airport Inspectors	3
Airport Inspector 2	Advanced regulations and responsibilities relating to airport licences, advanced pavement maintenance, concrete and bitumen, clearance surface theory and field survey, introduction to AIP-AGA	Airport Inspectors responsible for major airports	3
Airport Inspector 3	Annex 14 standards and compliance, advanced AIP-AGA, airfield safety (major airports including international), airport location and design	Airport Inspectors responsible for major airports and international airports	3
AIP-AGA	Purpose and use of AIP-AGA, amendment procedure, need to keep current.	Airport Inspectors, AMO's at regional and major airports, airport design engineers	1
Plant Operator 1	Safe use of simple mechanised plant, such as trucks, tractors, rollers, drawn graders, pavement marking machine, sweepers. Principles of maintenance. Practical sessions.	All AMO's, Reporting Officers and Airport Inspectors	2
Plant Operator 2	Specific plant items, e.g. large graders, front end loaders, etc. Practical sessions.	AMO's, Reporting Officers and Airport Inspectors as required	2

4. CNS / ATM

4.1. Existing Conditions

Most of the former air traffic management infrastructure of Afghanistan was destroyed in the fighting and the trained staff resources are critically depleted. Any buildings and equipment that remain are rudimentary and obsolete apart from the VSAT system which is quite new and is mostly in working order.

Currently, all air traffic management except for overflights is carried out by the military. Civil aviation operations are limited to daylight hours and specific, restricted routes. The slot system in operation at Kabul severely limits the number of aircraft movements and hence the number of domestic flights that can be operated in a day. Service provision to overflight traffic is inhibited by lack of suitable equipment and insufficient flight levels to accommodate demand. A coalition forces liaison officer is currently working with MCAT and Ariana to address these and other urgent issues.

4.2. Immediate Needs

The US Federal Aviation Agency (FAA) sent an investigation team to Afghanistan in mid 2002 and issued a report “Air Navigation Services Needs” in September 2002. FAA proposed a number of urgent actions to re-establish essential components of the air traffic management system and to remove some of the current restrictions to civil aviation, namely:

- enhancing of terminal services at Kabul airport;
- facilitation of Haj flights for January 2003;
- commissioning of Global Navigation Satellite System (GNSS) based procedures;
- restoring the national en route air-ground communications network; and
- expanding altitudes available to overflying civilian aircraft.

FAA recognised the critical shortage of trained technicians and operators and proposed an intensive training program augmented by utilisation of contract support and other external assistance, e.g. United Nations Volunteers (UNV) in specialised areas such as operations and maintenance. It is understood that MCAT is currently considering the appointment of a service provider to operate the system in the short term.

There is an urgent need for airport surveys and updating of aeronautical information. The production and dissemination of this information, including

the AIP and NOTAMS, could sensibly be included in the CNS/ATM service provider's brief.

4.3. Longer Term Requirements

FAA recommended additional actions, to be implemented concurrently with the above, which would concentrate on improving MCAT's capacity to provide air navigation services over a 2 to 4 year timeframe. The recommendations are:

- develop a national concept of operations and air navigation services architecture;
- establish a national training program for controllers and technicians;
- enhance terminal navigation services;
- improve terminal air-ground communications; and
- establish a Kabul Area Control Centre to provide procedural en route air traffic control.

4.4. Comment

The TSR has read the FAA report and agrees with the broad strategy and recommendations. The proposed improvements to the national air navigation facilities and services should be programmed to be compatible with the ICAO Air Navigation Plan (ANP) for the Central Asia Region and aimed at forming an integrated regional system.

Based on expected traffic requirements alone, (other considerations could be bad weather or difficult terrain), it would appear that the provision of air traffic services at some domestic airports is not justified, even though this may have been the case in the past[16].

4.5. Implementation

Necessary actions to implement the re-establishment of air traffic management and the proposed CNS/ATM program are outlined below.

- identification of donors and agreements for funding
- identification of TAs and appointment of consultants
- staff recruitment and training

[16] A similar argument also applies to the provision of rescue and fire services.

- deployment of trained staff to Kabul and outstations
- selection and appointment of CNS/ATM service provider (areas of responsibility to be documented and clarified)
- supply, installation and commissioning of equipment
- provision of new or renovated ATM facilities at airports
- aircraft to be fitted with required instrumentation (aircraft operator responsibility)
- institutional reform of MCAT to enable formation of Airways Division

All of the above and other details will need to be programmed and coordinated by a project manager (consultant company). Appointment of the project manager is a matter of some urgency. Consideration should be given to combining the project management of CNS/ATM implementation with airport upgrading implementation (refer section 3.7).

APPENDIX 1

DOMESTIC AIR TRAFFIC DEMAND

There is believed to be a large latent demand for domestic air services in Afghanistan. Currently, domestic air travel is constrained to artificial levels (either high or low) for a number of reasons including:

- flights run by UN agencies are organised to support UN activities and needs, such as transport of aid workers and humanitarian relief, or travel requirements of government ministers and officials;

- Ariana currently provides only limited RPT services for Afghans and others not travelling on official business and will not be able to re-commence flights to Kandahar in the foreseeable future; and

- many airports are not operating to capacity due to constraints on civil aviation operations (e.g. lack of aircraft, restrictions on number of movements at Kabul) and many are unuseable because of damage, protracted lack of maintenance, mines/UXO, and the like.

Thus, it is not possible to get an accurate picture of the likely pattern of domestic air services from current operations. Whilst a knowledge of service patterns from 20 years ago will provide some guidance, the structure of future domestic air services will be governed to a large extent by recent population shifts and improvements in road passenger and freight transport associated with the staged restoration of the national road system.

The situation of domestic airlines in the future is also unknown. Whereas formerly there were two competing airlines, this might not be the case within the study horizon. There are few civil aircraft currently in Afghanistan which would be suitable for domestic operations. Ariana's B727's currently operate between Kabul and Herat and Mazar-I-Sharif and the airline has recently acquired two AN24s for use on thinner routes. It is likely that B727s will be phased out within 4 to 6 years due to age and noise problems.

It is likely that the major domestic routes, including Kandahar, will be operated by a mixture of turbojet and propeller aircraft in the 50 to 150 seat range. This would include types such as a B737 variant, F28, ATR42/72 and AN24. The 50 seat aircraft would be suitable for the thinner routes between Kabul and regional centres such as Kunduz, Maymana, Faizabad and Bamyan (subject to operational clearance) and smaller aircraft down to 20 seat capacity could also be utilised depending on passenger demand. There are likely to be opportunities for third level operators to provide feeder services from regional hubs to small airports and remote airstrips, such as between Faizabad and Darwaz, Khwahan and Sheghnan using a variety of single and twin engined

light aircraft such as Cessna 182, Beech Baron, Cessna Caravan and Twin Otter.

This paper does not attempt to make detailed aviation forecasts for domestic traffic when it re-starts in earnest. However, indicative figures are provided on the following spreadsheet which is based on assumed numbers of daily return flights between the ports indicated. The numbers are not specific to any particular year.

It is intended that these figures can be used to assist planning of facilities until more sophisticated forecasts and actual data become available.

AIRCRAFT AND PASSENGER MOVEMENT ESTIMATES

Aircraft and Passenger Movements

From	To	Return flts per day	Kabul	Kandahar	Mazar-I-Sharif	Herat	Jalalabad	Faizabad	Maimana	Bamyan	Kunduz	Farah	Chagcharan	Zaranj	Khojaghar	Khwahan	Darwaz	Sheghnan	Sherberghan	Totals
Kabul	Kandahar	2	4	4																
	Mazar	2	4		4															
	Herat	2	4			4														
	Jalalabad	1	2				2													
	Faizabad	1	2					2												
	Maimana	1	2						2											
	Bamyan	1	2							2										
	Kunduz	1	2								2									
Kandahar	Herat	1		2		2														
	Zaranj	1		2										2						
	Farah	1		2								2								
Herat	Mazar	1			2	2														
	Farah	1				2						2								
	Zaranj	1				2								2						
Maimana	Sherbergh	1							2										2	
	Bamyan	1							2	2										
	Mazar	1			2				2											
Mazar	Faizabad	1			2			2												
	Bamyan	1			2					2										
	Kunduz	1			2						2									
Faizabad	Kunduz	1						2			2									
	Khojaghar	1						2							2					
	Khwahan	1						2								2				
	Darwaz	1						2									2			
	Sheghnan	1						2										2		
Bamyan	Chaghchar	1								2			2							
Total daily movements			**22**	**10**	**14**	**12**	**2**	**14**	**8**	**8**	**6**	**4**	**2**	**4**	**2**	**2**	**2**	**2**	**2**	**116**
Annual movements			**8,030**	**3,650**	**5,110**	**4,380**	**730**	**5,110**	**2,920**	**2,920**	**2,190**	**1,460**	**730**	**1,460**	**730**	**730**	**730**	**730**	**730**	**42,340**
Passenger movements			**361,350**	**164,250**	**229,950**	**197,100**	**10,950**	**76,650**	**43,800**	**43,800**	**32,850**	**5,840**	**2,920**	**5,840**	**2,920**	**2,920**	**2,920**	**2,920**	**2,920**	**1,189,900**
Maximum no of acft on ground																				
	70 seats and above		6	2	2	2	2			1	1									
	less than 70 seats		6	3	4	3		4	4	4	3	1	2	1	1	1	1	1		

Pax mvts assumptions		No of seats per acft	Load factor
	major airports	60	75%
	other regional airports	20	75%
	small airports	4	100%

Average for all aircraft types

Pax Movements - All Afghanistan				
Assumed sensitivity		-50%		
		+100%		
Range	Low	0.6	Million	594,950
	Expected	1.2	Million	1,189,900
	High	2.4	Million	2,379,800

APPENDIX 2

AIRPORT DATA (APRIL 2003)

AFGHANISTAN AIRPORT INFORMATION

SOURCE: AFGHAN AIP (Dec 1990) AND UPDATES FROM UNJLC WEBSITE (Jan 2003)

Airport	Elev	Rwy	Length	Rwy Width	Surface	Aircraft	Notes
Kabul	5,866	11/29	3,500	47	asphalt	B747, IL76	PCN61/R/B/W/T Pavement strength unlimited. Obstructions (mountains) in landing and takeoff areas severely restrict operations.
Kandahar	3,317	05/23	3,200	45	asphalt	C130, C17	Twy 23m wide
Jalalabad	1,814	13/31	2,195	45	asphalt	C130	
Herat	3,206	01/19	2,500	45	asphalt	B727, IL76	
Mazar-e Sharif	1,243	06/24	3,200	45	asphalt	C130, C17	Significant depression 450m from rwy 06 threshold. Parallel twy 23m wide.
Bamyan	8,365	06/24	2,590	23	gravel	C130	40 m graded strip width narrows to 20 m across ravine near centre. Buildings close to rwy at NW end
Faizabad	3,872	18/36	2,000	34	steel plank	C130	Caution: steel planks may be loose or damaged, beware protruding edges. Twy and apron concrete Taxiway 10m wide. No strip. No security fence
Kunduz	1,426	11/29	2,000	45	asphalt	C130	
Maymana	2,690	14/32	2,000	24	gravel	C130	some large stones
Chaghcharan	7,383	07/25	1,950	21	gravel	C130	35 m graded strip width. Rwy is soft after rain. Caution: a/p is ringed by minefields
Farah	2,208		2,600	30	nat surf		Unuseable?
Ghazni	7,149		?	21	asphalt		Unuseable

AFGHANISTAN AIRPORT INFORMATION

SOURCE: AFGHAN AIP (Dec 1990) **AND UPDATES FROM UNJLC WEBSITE (Jan** 2003)

Airport	*Elev*	*Rwy*	*Length*	*Rwy Width*	*Surface*	*Aircraft*	*Notes*
Lal	9,369		700	27	nat surf		Being extended to 1,400 m
Mukur	6,600		1,835	24	nat surf		unuseable
Quala-I-Naw	2,998	04/22	2,100	#DIV/0!	gravel	Beech	1,800 useable. No apron. Beware UXO >15m either side of rwy. 40 m graded strip width?
Sherberghan	1,053		2,600	24	asphalt	C130	
Shindand	3,773		1,600	49	concrete	C130	
Yakawlang	8,600	03/21	1,700	30	gravel	C130	soft after rain
Zaranj	1,572	16/34	2,300	40	nat surf	C130	soft after rain
Bost	2,464	01/19	2,000	45	gravel		
Darwaz	5,250	10/28	700	30	nat surf		
Khojaghar	1,608	10/28	2,400	40	gravel		
Khwahan	3,583	17/35	700	30	nat surf		
Kron Monjan	8,415	09/27	900	30	gravel		
Tereen	4,429	11/29	1,550	40	nat surf		
Sheghnan	6,700	15/33	750	30	nat surf		

APPENDIX 3

AIRPORT DESIGN STANDARDS

Background

The International Civil Aviation Organisation (ICAO) has developed standards and recommended practices to ensure the safety and efficiency of air transport and airport facilities. In particular, aerodrome physical standards are defined and explained in detail in ICAO document Annex 14. These standards and recommended practices have been adopted as the basis for the airport planning undertaken in this report.

Where full conformity with the relevant ICAO standard or recommended practice is not possible a note is generally made to this effect in the national Aeronautical Information Publication (AIP). Additionally, contracting States may also notify ICAO of differences from airport standards and these differences are published in a supplement to Annex 14. In some cases, it may be necessary for the controlling authority, i.e. MCAT, to issue an *operational concession* to the aircraft operator in order to formalise and control operations at aerodromes where facilities do not meet ICAO standards. The concession document will define any conditions that are placed on the operation either for safety or other reasons, for example, where takeoff weight may have to be limited.

Brief Overview of the ICAO System

ICAO uses a category system to classify aerodromes and aircraft types which provides a simple method of interrelating the numerous specifications concerning the characteristics of aerodromes so as to define minimum facility standards that are suitable for the aeroplanes which are intended to operate at the aerodrome. It should be noted that many of the specifications are not “hard and fast” but they nevertheless provide useful guidelines for airport planners. ICAO also publishes a number of design manuals that give additional information and practical advice for designers and engineers.

The ICAO Aerodrome Reference Code is reproduced in Table 1 and some examples of aerodrome physical standards showing how these are linked to the reference code are given in Table 2. A list of representative aircraft and their ICAO codes is given in Table 3. Study of these three tables illustrates how the standard of aerodrome facilities is related to aircraft type.

The reference code is composed of two elements, the first of which is related to the aeroplane performance characteristic (i.e. a “reference field length” for takeoff) and the second, to the wingspan or dimensions of the landing gear, whichever is the more critical. For example, a B767-300 which has a wingspan of 47.57m, an outer main gear wheel span of 9.3m, and a reference field

length in excess of 1800 metres, is a Code 4D aircraft. Thus, if designing an airport, or certain facilities for a B767-300 as the *design aircraft*, runway, geometric, and other standards appropriate to Code 4D should be used. Airports designed for B747 or B777, on the other hand, should correspond to Code 4E.

Annex 14 provides comprehensive data on all physical elements of the airport, based on the aerodrome reference code. These will not be reproduced in this report but include such items as:

- width of runways, taxiways and runway and taxiway strips;
- longitudinal and transverse slopes on runways, taxiways and aprons;
- separation distances between taxiways, runways and obstacles;
- dimensions and slopes of obstacle limitation surfaces;
- runway markings and visual aids;
- airport and approach lighting systems; and
- standard of rescue and fire fighting vehicles.

Table 1. ICAO Aerodrome Reference Code

Code element 1		*Code element 2*		
Code number	***Aeroplane reference field length***	***Code letter***	***Wing span***	***Outer main gear wheel span****
(1)	***(2)***	***(3)***	***(4)***	***(5)***
1	Less than 800m	A	Up to but not including 15m	Up to but not including 4.5m
2	800m up to but not including 1,200m	B	15m up to but not including 24m	4.5m up to but not including 6m
3	1,200m up to but not including 1,800m	C	24m up to but not including 36m	6m up to but not including 9m
4	1,800m and over	D	36m up to but not including 52m	9m up to but not including 14m
		E	52m up to but not including 60m	9m up to but not including 14m

* Distance between the outside edges of the main gear wheels.

Source: ICAO Annex 14

Table 2. Aerodrome Physical Standards Related To Reference Code

Item	*Code number*			
	1	*2*	*3*	*4*
Width of runway				
Code letter A	18m	23m	30m	--
Code letter B	18m	23m	30m	--
Code letter C	23m	30m	30m	45m
Code letter D	--	--	45m	45m
Code letter E	--	--	--	45m
Width of runway plus shoulders	Where the code letter is D or E, the overall width of the runway and its shoulders shall be not less than 60m			
Runway				
Maximum longitudinal slope	1.5%	1.5%	1.25%	1.25%
Maximum effective gradient	2.0%	2.0%	1.0%	1.0%
Maximum longitudinal slope change	2.0%	2.0%	1.5%	1.5%
Maximum transverse slope	2.0% where the code letter is A or B; and 1.5% where the code letter is C, D or E			
Width of runway strip				
Precision and non-precision runway	150m	150m	300m	300m
Non-instrument runway	60m	80m	150m	150m
Strip				
Maximum longitudinal slope	2.0%	2.0%	1.75%	1.5%
Maximum transverse slope	3.0%	3.0%	2.5%	2.5%

Source: Information collated from ICAO Annex 14

Table 3. Aircraft Characteristics and ICAO Reference Codes

Aircraft Type	*ICAO Code*	*Wing Span (m)*	*Length (m)*	*Tail Height (m)*	*Max Takeoff Mass (tonnes)*	*Typical seating capacity*
B747-400	4E	64.30	70.70	19.30	394	400
B777-200	4E	60.95	63.73	18.45	268	363
AN124	4E	73.30	69.10	20.78	405	Cargo
DC10-30	4D	50.42	55.20	17.70	264	380
MD11	4D	51.60	61.20	17.60	273	405
B767-300	4D	47.57	54.90	16.13	185	235
B757-200	4D	38.05	47.33	13.56	123	186
A300-B4	4D	44.83	53.61	16.72	158	230
A320-200	4C	34.57	39.24	11.85	72	150
B727-200	4C	32.92	40.60	10.65	89	150
B737-400	4C	28.88	36.30	11.12	63	140
B737-300	4C	28.88	33.40	11.12	62	112
F28-1000	3B	23.58	27.40	8.47	30	65
F28-4000	3C	25.07	29.61	8.47	33	85
An24	3C	29.20	23.80	8.58	22	50
Y7-100	3C	29.67	24.2	8.55	22	50
Saab 340	2B	21.44	19.71	6.87	12.3	35
Twin Otter	1B	19.81	15.79	5.94	5.7	20
Y-12	1B	17.24	14.86	5.68	5.3	17

Source: Jane's "'All the World's Aircraft", manufacturer's data.

APPENDIX 4

COST ESTIMATES

Notes on Costs

1. The cost estimates exclude the cost of land acquisition, project management and design fees, allowances for cost escalation, currency fluctuations and contingency.

2. All costs are expressed in US dollars at 2003 value.

3. In the current climate, it has not been practical to determine standard rates from MPW or contractors for the proposed airport construction works. The rates adopted as the basis for cost estimates in this report are given after the cost estimates.