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Koblenz.
08.10.93

Dear Mr. Cato,

St. Vincent Airport Development, Pre-Investment Study
Inception Report

We take pleasure in submitting to you the Inception Report in six copies.

Preliminary work has assessed all locations indentified earlier, and has focused on the existing airport at Arnos Vale, the site at Kitchen, and at Argyle. Engineering reconnaissance and preliminary aeronautical assessment suggested that a new airport can be built at either new site, but with better future potential at Argyle, where a 150 m wide runway strip could be built initially at least costs, extendable to 300 m runway strip width as instrument runway.

The Report is submitted for your review, comment and selection of one new site for further evaluation and comparison with development of the E.T. Joshua Airport.

Yours faithfully

KOCKS CONSULT GMBH
Consulting Engineers

i. A.

Werner P. Weiler

Encl.

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1. INTRODUCTION

1.1 Study Background

St.Vincent and the Grenadines is located in the Eastern Caribbean about 100 miles west of Barbados. It has a total land area of some 150 square miles and an estimated population of 108,000. The economy is based chiefly on agriculture which is the largest productive sector accounting for 17.4% of GDP and almost 80% of merchandise exports in 1992. Although tourism only accounts for 2.5% of GDP (as measured by the share of hotels and restaurants in GDP), it is becoming increasingly significant and has considerable growth potential given the country's idyllic tropical location. Manufacturing, which has recently been sluggish and only accounts for 8.9% of GDP, is showing signs of recovery and is also seen as a key element in the Government's development strategy.

Government policy is designed to achieve balanced growth and sustainable development by promoting agriculture, industry and tourism. Although the demand for air transport services will reflect the success or otherwise of this policy, demand will itself be largely stimulated by the supply of the appropriate airport infrastructure. Indeed, the inadequacy of existing facilities is currently perceived as a major constraint in the promotion of growth.

Because of the complexity in the dynamics of this relationship between the supply of air transport facilities and the demand for air transport services, it is not always possible to establish cause-and-effect relationships. What is, however, self-evident is the need to assess the adequacy of the existing airport and the need for improvements, given the expectation of reasonable growth in air traffic.

1.2 The Existing Airport

The existing E.T.Joshua airport is the main gateway to St.Vincent and the Grenadines and is located at Arnos Vale, approximately two miles south of the capital, Kingstown. It functions as a regional airport with scheduled flights to Antigua, Barbados, Martinique, St.Lucia, Grenada and Trinidad. Transfers and connections can then be made to more distant destinations. It also serves for domestic flights to the Grenadine islands of Bequia, Canouan, Mustique, Palm and Union, which all have land airports.

The airport has one runway, which is 4,650 feet long and 150 feet wide. It is designated 07/25 and according to ICAO standards for non-instrument runways has the classification code 3C. It currently has a load classification number of 18, which is sufficient to handle aircraft up to 55,000 lb, including the HS 748 and similar types. The airport possesses one non-directional beacon, but operations are only possible under visual flight rules.

Although the site is reasonably flat, it is subject to certain topographical constraints being surrounded on three sides by steep hills and located adjacent to the sea. The topography and the prevailing easterly trade winds are severe operational restrictions. The high ground not only dictates the runway alignment but also restricts aircraft movements. All landings must be made on runway 07 with an approach from the sea towards the high ground. Because the runway cannot be overflown at low altitude, aborted landings are extremely hazardous. All take-offs are on runway 25 heading away from the high ground towards the sea, a downwind direction with all the associated problems of airspeed, safety margins and take-off weights. Finally, and because of the confined nature of the site, all around Arnos Vale there are also violations of the ICAO obstacle free zones which are designed to ensure safety and a margin of error for aircraft operations.

The airport has other shortcomings with respect to apron and terminal facilities which are severly congested at peak times, and the pavement structures on the airfield have exceeded their technical life expectancy and need resurfacing. Improvements to these facilities are, however, currently under consideration.

Because of these and other constraints, only relatively small aircraft operate regularly at Arnos Vale including DHC 8, ATR 42, BAe ATP and HS 748. Of these, the critical aircraft is currently the HS 748 as used by LIAT. It carries 44 passengers and is sometimes subject to weight restrictions due to tailwinds, although this is not a major problem due to the short stage lengths operated. It is, however, reaching the end of its useful service life and more operationally efficient and economical replacements, such as the 37 seater DHC 8, are being introduced. More recently, occasional cargo flights by Amerijet, employing a B 727, have been allowed subject to weight restrictions, but these are already have a detrimental impact on the runway pavement. In the medium term, and if the country's development strategy is to succeed, there will be a need for more frequent medium range prop and jet aircraft, such as the B 737, which would necessitate a runway extension for operations at reasonable weights.

1.3 The Study Objectives

The St.Vincent Airport Development Pre-investment Study has been commissioned by the Central Planning Division and, as indicated in the Terms of Reference, aims to assess the air transport needs of St.Vincent and its environs and to outline the most appropriate means by which to address these needs. The study is to identify and formulate a project suitable for funding by international financing institutions to either improve the existing airport at Arnos Vale or develop a suitable alternative to acceptable standards which is financially and economically viable. Specifically, the studies objectives are:

i) to prepare an air transport sector profile by collecting, analyzing and verifying data to establish the demand for air services over the next two decades ;

ii) to identify technically feasible improvements to cater for this demand, and to prepare an airport layout and programme to upgrade airport facilities either at the existing airport at Arnos Vale or at any other suitable location within the island, to handle anticipated traffic with acceptable international standards for efficiency, safety and passenger comfort;

iii) to compare the costs and benefits of the improvements identified in order to establish the preferred alternative and the optimum timing of investment; and

iv) to prepare a feasible schedule for implementing the preferred alternative.

1.4 The Study Programme

The study is being conducted by Kocks Consult GmbH of Germany and work commenced immediately following the contract signing ceremony on the 15th September, 1993. It is programmed to last three months.

The methodology is as described in detail in the technical proposal, although the actual sequence of study tasks has been amended, with the revised schema illustrated in Figure 1.1. The resulting programme of work over the study period is indicated in Figure 1.2. Meanwhile, and following discussions with Mr. Randolph Cato, the Director of Planning in the CPD, the study team and the proposed deployment of team members has also been amended slightly from that originally proposed, although the total input remains unchanged at 9.50 person-months. The revised staff deployment schedule is as illustrated in Figure 1.3.

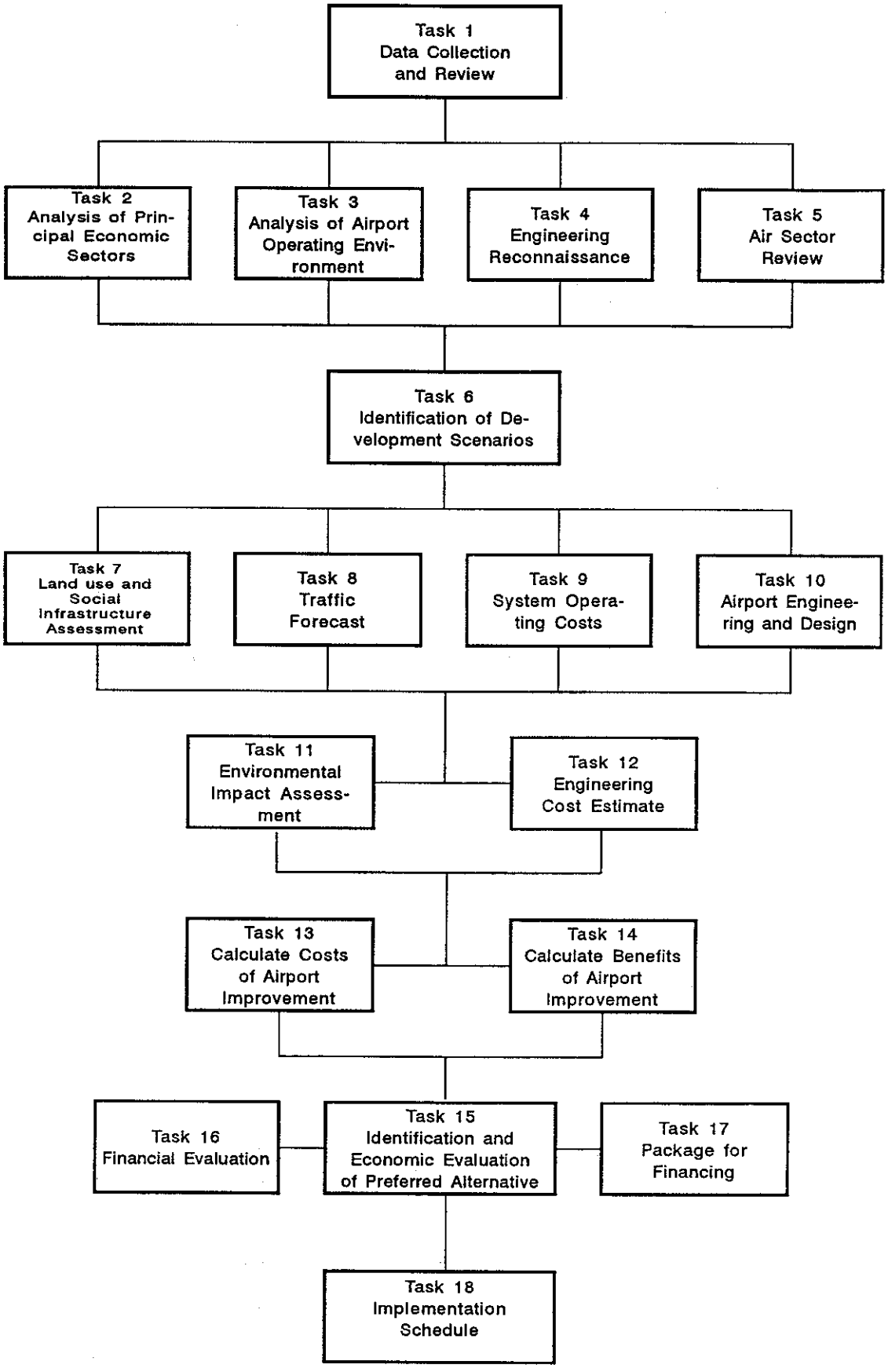

Figure 1.1 Study Methodology

Month		1			2				3			
Week		4			8				12			
Task	**Activity**											
0	Notification 2 weeks before Commencement											
1	Data collection and review	X										
2	Analysis of economic sectors		X	X								
3	Analysis of airport operating environment		X									
4	Engineering reconnaissance		X	X								
5	Air sector review		X	X								
6	Identification of development scenarios			X								
7	Land-use and infrastructure assessment			X	X							
8	Traffic forecast				X							
9	Operating system costs				X							
10	Airport engineering				X	X	X					
11	Environmental impact assessment					X	X					
12	Engineering cost estimate						X					
13	Costs of airport improvement						X					
14	Benefits of airport improvement							X				
15	Economic evaluation of preferred alternative								X			
16	Financial evaluation									X		
17	Package of financing										X	
18	Implementation schedule											X
19	Inception Report											
20	Draft Final Report											

Figure 1.2 Work Programme

Month		1	2	3				
Week						Field	Home	Total
Position on team	**Name**							
Team Leader/Airport Engineer	Werner P. Weiler	X H	X	HHH		2	4	6
Economist/Planner	Brian Field	XXXH	H	H H		3	4	7
Airport Operations Specialist	Gerd Beinsen	H	X	HH		1	3	4
Environmentalist	Melanie Pörschmann	XHH				1	2	3
Navaids/Navcom	Bernd Funke	X H	HHHH	H		1	6	7
Design Engineer 1	Willems/Jullemier	X	HHH	XX		3	3	6
Design Engineer 2	Michael Baumann	H	H			-	2	2
Architect	Winfried Koehler		HHH			-	3	3

Note: X = Time in St. Vincent (Field)
H = Time in home office

Inception Report
Draft Final Report
Total Weeks

Figure 1.3 Staff Deployment Schedule

1.3 Study Progress

This Inception Report is the first study report to be produced and includes:

i) details of preliminary consultations with relevant Government departments and other interested parties;

ii) a review of existing data/information and previously published studies; and

iii) assessment of alternative sites for new airport development and identification of suggested options for detailed evaluation in comparison with upgrading the existing facility.

2. CONSULTATION AND REVIEW

2.1 Consultations and Publicity

A press and media briefing by the Prime Minister, the Rt.Hon. J.F.Mitchell, accompanied the contract signing ceremony and resulted in extensive coverage of the project on both television and in the national press. This high profile introduction to the study has facilitated access to public agencies and other bodies who have been most cooperative.

Preliminary meetings have been held with officials of various Government departments and other affected parties to introduce the study team, identify key issues, and request data. In alphabetical order, these include:

Alastair Alexander	Director of Airports, Ministry of Communications and Works.
Terrence Babb	Economist, Central Planning Division, Ministry of Finance and Planning.
Kenny Baker	Senior Project Officer, Central Planning Division, Ministry of Finance and Planning.
Candace Bennett	Acting St.Vincent Station Manager, Liat Ltd.
Michael Bennett	Acting Port Manager, Kingstown Port Authority.
Keith Boyea	Manager, BMC Agencies Ltd, Agent for Amerijet International Inc.
Bentley Browne	Physical Planner, Central Planning Division, Ministry of Finance and Planning.
Vidal Browne	Managing Director, Young Island Beach Resort.
Richard Campbell	Economist, Central Planning Division, Ministry of Finance and Planning.
Jeffrey Cato	Chief Engineer, Ministry of Communications and Works.
Randolph Cato	Director of Planning, Central Planning Division, Ministry of Finance and Planning.
Decima Corea	Projects Officer, Central Planning Divison, Ministry of Finance and Planning.
Calvert Ferdinand	Quantity Surveyor, Central Planning Division, Ministry of Finance and Planning.
Shirla Francis	Statistical Officer, Central Planning Division, Ministry of Finance and Planning.
Karl John	Director, Agricultural Rehabilitation and Diversification Project, Ministry of Finance and Planning.
Colin Jones	UNDP Technical Advisor, Central Planning Division, Ministry of Finance and Planning.
Claude Leach	General Manager, The Development Corporation.
John McLean	Acting Chief Statistician, Central Planning Division, Ministry of Finance and Planning.
Jonathan Palmer	Chairman, Mustique Airways.

Rubin Robinson	Agricultural Planner, Ministry of Agriculture, Industry and Labour.
Tony Sardine	President, St.Vincent and the Grenadines Hotel Association.
Theophilus Shallow	Senior Economist, Central Planning Division, Ministry of Finance and Planning.
Clifford Williams	Chief Surveyor, Ministry of Agriculture, Industry and Labour.
Karl Williams	Administrative Officer, Kingstown Port Authority.
Leroy Wilson	St.Vincent Station Manager, Air Martinique.
Beverley Warren	Population Planning Coordinator, Central Planning Division, Ministry of Finance and Planning.
Janet Woods	General Manager, Department of Tourism, Ministry of Foreign Affairs and Tourism.

Following these meetings, a considerable amount of data has been compiled and is being processed as the existing economic situation is reviewed and opportunities for growth evaluated. This has been complemented by a preliminary review of the air transport sector to identify service and operational deficiencies in meeting economic goals.

2.2 Review of Previous Studies

There have been a number of previous studies relating to airport development and these have also been reviewed to assist in the compilation of the data base. Where inadequacies or inconsistencies in these studies have been identified, supplementary surveys to correct and reconcile the basic data have been initiated. The studies reviewed, in chronological order, include:

i) *St.Vincent Airport Study, Civil Aviation Authority (UK), 1974.*

This study focused on three possible options for airport development. These included further development at Arnos Vale, a new airport in the Langley Park/Waterloo area, and a new airport in the Brighton/Diamond area. Of the two new sites, the CAA favoured that at Brighton/Diamond because of its greater proximity to Kingstown. However, the runway alignments in both cases were essentially north-south and, given the problem of crosswinds and the need for extensive and costly excavations, a new airport was rejected in favour of further development at Arnos Vale. Expansion at Arnos Vale and a possible runway extension to 7000 feet by reclaiming land from the sea was mooted but, in the absence of any formal economic analysis/appraisal, the study concluded that such a development might prove prohibitively costly and suggested that operations could reasonably continue without such an extension.

ii) *Caribbean Airport Maintenance and Operations Study, International Civil Aviation Organisation & the Caribbean Development Bank, 1979.*

This study on airport operations focused on engineering, fire and rescue and navigational aid facilities. Recommendations were made to how these could be improved and how such improvements might be partially financed by the more effective exploitation of user charges.

iii) *Arnos Vale Airport St.Vincent: Runway Extension, ADeB Consultants Ltd (Jamaica), 1980.*

This study detailed engineering work necessary to extend the existing runway at Arnos Vale seaward to Black Rock by some 2000 feet. The reclamation was to be constructed by depositing sand dredged from Gateshead Bay. The study included preliminary designs and cost estimates which suggested that the work could, at that time, be completed for US$7.5 million.

iv) *Civil Aviation: Expansion of Airport Facilities, United Nations Development Programme & the International Civil Aviation Organisation, 1981.*

The objective of this study was to examine the possibilities for upgrading and expansion at Arnos Vale and to compare these with the possibilities for building a new airport elsewhere. The development of a new facility was rejected as being too expensive at an estimated cost of EC$1000 million and out of all proportion to the island's economic status. Meanwhile, and given a much higher cost estimate than in previous studies for improving Arnos Vale of EC$155 million, it was recommended that even an upgrading project should be postponed pending more detailed studies/forecasts of future passenger and freight demand, and likely developments in operational aircraft types.

v) *Development of Arnos Vale Airport, Plessey Airports Ltd, 1983.*

Notwithstanding the absence of more detailed research on likely demand, the Plessey company in association with Rendel Palmer and Tritton produced a proposal for the development of Arnos Vale. This included a runway extension to 7000 feet to accommodate medium range jet aircraft up to DC9/B737 size. Given that not only size of aircraft but also the volume of traffic would increase, a number of other facilities particularly in the area of the passenger terminal were also recommended for improvement, as were improvements in navigational and other operational equipment.

vi) *Report on the Economic Feasibility of Improvements to Arnos Vale Airport St.Vincent, Norman Ashford for Plessey Airports Ltd, 1983.*

Plessey commissioned Professor Norman Ashford to appraise the economic feasibility of the project. In his analysis of the benefits of the proposed improvements, Ashford considered both direct benefits which would accrue from increased airport revenues in the form of landing fees for additional passenger and freight aircraft and the airport exit tax, and indirect benefits that would accrue in the form of corporate and personal taxes from economic activities which could reasonably be attributed to the improvements. Based on direct revenues alone, the benefit:cost ratio of the project was estimated at 0.26. If both direct and indirect revenues were included in the calculation, the benefit:cost ratio became a respectable 1.75. If grant aid were available for the permanent works, the resulting fall in direct costs would result in a benefit:cost ratio of 0.37 when considering only direct revenues, but would rise to 2.51 if indirect revenues were included in the computation. Given domestic budget constraints and for the project to be given the go ahead, co-financing was necessary but this was not forthcoming and the project was again shelved.

vii) *Transport Sector Study, United Nations Development Programme & the Inter-Agency Resident Mission, 1984.*

This broad based review revived discussion of the need for improved airport facilities and recommended that the air transport subsector should be the subject of a definitive study on future requirements and development to resolve outstanding issues in air transport that were perceived to be constraining tourism, industrial and agricultural development.

viii) *Proposal for the Development of Arnos Vale Airport, Central Planning Unit, 1985.*

Similar to the earlier studies by ADeB and Plessey, this study set out in broad terms the technical scope of the works involved for the development of Arnos Vale Airport and their operational implications. It did not include detailed engineering tests to confirm the efficacy of the proposals and to prepare designs.

ix) *Arnos Vale Land Use Plan, Airports Authority Group (Transport Canada) for the Canadian International Development Agency, 1987.*

This study was not a commitment to expand facilities and services at Arnos Vale, rather it was designed to provide a broad framework within which future proposals for improvement could be evaluated. The plan's purpose was to minimise land use conflicts, to provide adequate protected areas for key aviation facilities, to reserve sufficient land for future improvements and to provide adequate supplies of marketable land for commercial development. Not surprisingly, it recommended acquisition of additional land to the north of the runway and west of the terminal building, or at least the earmarking of these land parcels as airport reserve.

x) *Airport Development in St. Vincent: A Pre-feasibility Study, Central Planning Unit, 1988.*

The main objective of this study was to take a broad look at airport development in St. Vincent, with particular regard to alternatives for the future. It included a comprehensive review of all previous studies and a reconciliation of previous recommendations to establish a broad policy framework for future action. As a pre-feasibility study, it provided the background for a proposed major feasibility study, for which finance was being sought, which would finally define a policy and formulate a project for future airport development.

xi) *St. Vincent E.T.Joshua Airport: Reinforcement and Repairs Preliminary Design, BCEOM, 1993.*

As the title suggests, this study followed the commissioning by Government of consultancy services to design and supervise reinforcement and miscellaneous works including runway resurfacing, new apron and taxiways, sea defence improvement, drainage rehabilitation and airport lighting rehabilitation. It forms part of a general upgrading of facilities which includes services by other consultants/contractors to provide a new cargo hanger (fresh produce facility) and improvements to the main terminal building.

xii) *St. Vincent and the Grenadines: E.T.Joshua Airport Feasibility Study, Sofreavia, 1993.*

The purpose of this study was to measure the profitability of proposed investments in airport improvement, including runway resurfacing and extension of the cargo apron, and to specify the advantages of their realisation. For a total investment of EC$21.8 million, the analysis shows impressive returns with both NPV and EIRR calculations confirming that the project should be undertaken. However, some of the key assumptions are questionable, as are parts of the methodology applied, and there is also no consideration of the extent to which such a large investment might "crowd out" borrowing for other airport investment.

As can be seen in the above review, a recurring and still unresolved issue is the desirability of expansion at Arnos Vale versus development of a completely new airport at another location. Over the years, several different sites have been considered for relocation and a summary evaluation of these is included in Section 3.

Meanwhile, and taking cognizance of these previous studies, a number of improvements have taken place at Arnos Vale, but substantive and meaningful improvements have frequently been postponed since these have often been considered as premature pending a decision on longer term airport strategy. The net result is a less than satisfactory operational environment, even allowing for existing topographical and other constraints, with the airport undoubtedly functioning sub-optimally. When implemented however, recent proposals to upgrade facilities will do much to redress current deficiencies, albeit only as relatively short term palliatives.

3. SITE EVALUATION

3.1 Site Alternatives

The consultancy team has visited and inspected all sites considered by previous studies which, with the exception of sites at Buccament Valley and Langley Park, lie in the south-southeast coastal area within an arc from Villa to Peruvian Vale, a district frequently referred to as Brighton/Diamond. The location of these sites is illustrated in Figure 3.1.

Buccament Valley, option 1 in Figure 3.1, is about five miles north of Kingstown on the leeward side of St.Vincent. The valley has a long flat floor which could accommodate a substantial runway but is surrounded by mountains rising to over 3000 feet to the north, east and south. Aircraft movements would only be possible at one end of the runway, therefore, with downwind take-offs and all the attendant problems of thermals and downdrafts due to the proximity of the mountains. Because development of this site would offer no obvious advantages over redevelopment at Arnos Vale, and at much greater cost, it need be considered no further.

Langley Park, option 2, is on the windward side of the island in the north-east district just north of Georgetown. This is one of the flattest areas in St.Vincent and would undoubtedly be topographically suitable for airport development. However, the lie of the land would necessitate a north-south runway alignment, to allow take-offs and landings in both directions, with all the associated problems of crosswinds which can be very strong indeed. The problems created by crosswind operations, which alone are sufficient to rule out airport development, are exacerbated by the site's location within the hazard zone of La Soufiere volcano and its distance some 25 miles from Kingstown, currently about one hour's drive.

The consideration of sites in the Brighton/Diamond area has rarely extended to suggestions for definitive runway alignments, although the Central Planning Unit's 1988 study attempted to rationalise previous work, an exercise that resulted in the definition of five possible corridors. These all provided for aircraft movements in both directions on a 7000 feet runway with approaches and climbs mainly over the sea. They also allowed for the possibility of further extension to 12000 feet in the long-term when there might be an opportunity to operate wide-bodied jets on more distant intercontinental sectors, although this seems unlikely as the major international carriers implement the "hub and spoke" concept in an operational environment where only two, or at most three, hubs are likely to prove economic.

Because of topographical considerations, three of the options, 3,4 and 5, have a runway alignment which is essentialy north-east to south-west. Although options 3 at Diamond and 4 at Brighton are only about six miles from Kingstown and well located close to the main tourist areas and the Diamond industrial estate, both would involve a considerable amount of costly excavation yet still be in the vincinity of relatively high and dangerous obstructions. Option 5 at Argle, meanwhile, is in an area of gently sloping hills about nine miles from Kingstown and well located close to many of the key agricultural areas along the windward coast as well as the Diamond industrial estate. It is relatively free of obstructions and would give rise little nuisance in an area of sparse development. But it would be subject to crosswinds much of the time, which would reduce its usability factor to an unacceptable level.

Option 6, in the Villa area, has an alignment which is north-west to south-east and, although subject to crosswinds, is better sheltered than those mentioned above. It would, however, necessitate the demolition and relocation of much of St.Vincent's best tourist accommodation as well as destruction of some of the island's best beaches and is, therefore, environmentally unacceptable.

Option 7, in the Kitchen area, is perfectly aligned from an operational point of view but is constructed almost entirely on reclaimed land and at great expense.

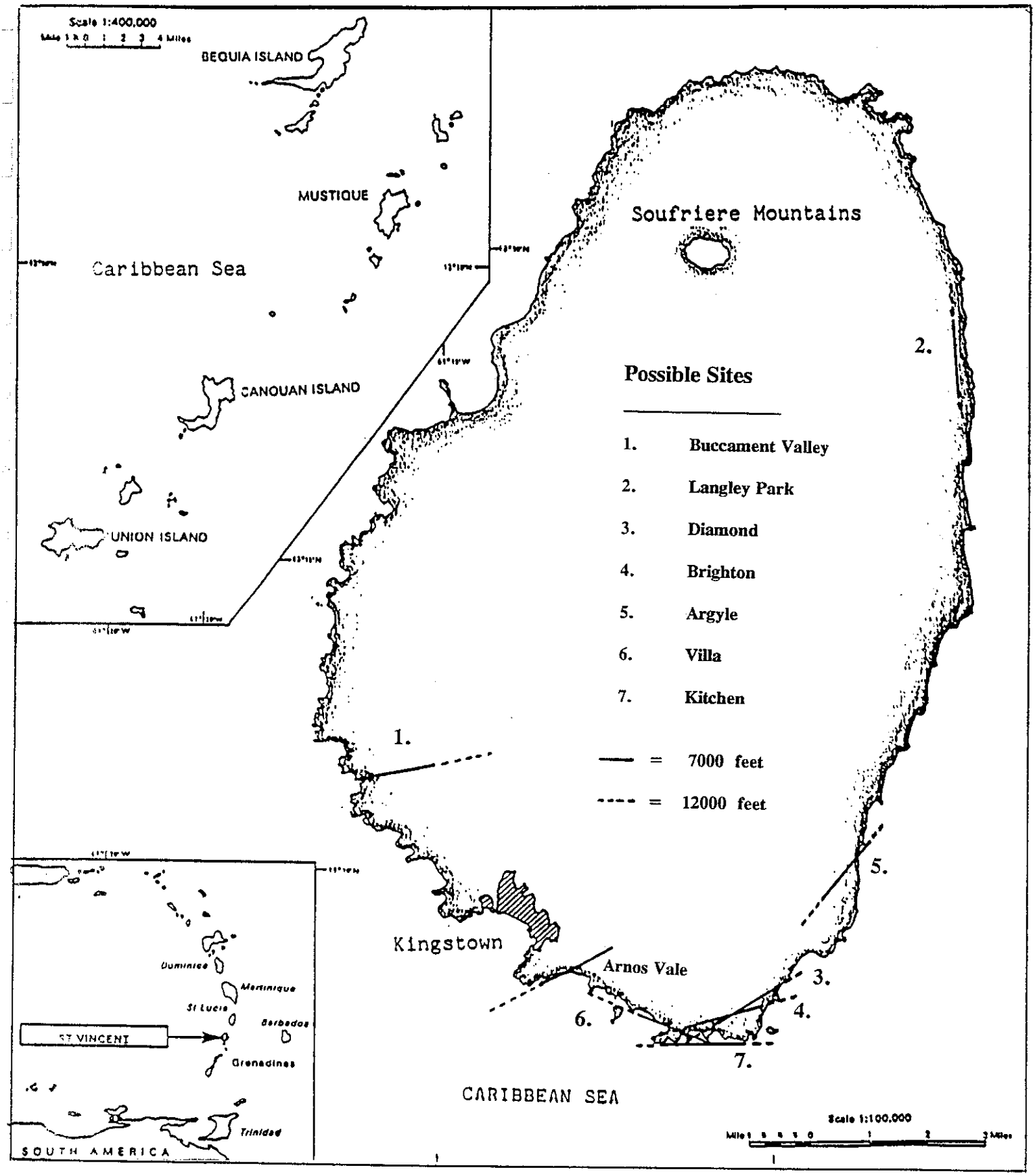

Figure 3.1 Alternative Airport Development Sites

The recognition that options 5 and 7 are probably the best, although the alignments are not ideal, lies behind the consultancy team's consideration of the two further options not previously been addressed and illustrated in Figure 3.2, which attempt to optimise the advantages of these two corridors. The first involves a realignment of the Argyle scheme to minimise crosswind interference and raise the usability factor to a more acceptable level, whilst the second shows a more northerly alignment for the Kitchen scheme which attempts to reduce the extent of reclamation and hence costs.

It is the elaboration of these options and their evaluation in comparison with extension and improvement at Arnos Vale, as illustrated in more detail in the preliminary layout plans in Appendix A, that merit consideration as feasible development alternatives. They are, therefore, considered in Section 4, it being assumed that the initial development will be for a runway strip of approx. 2,000 metres.

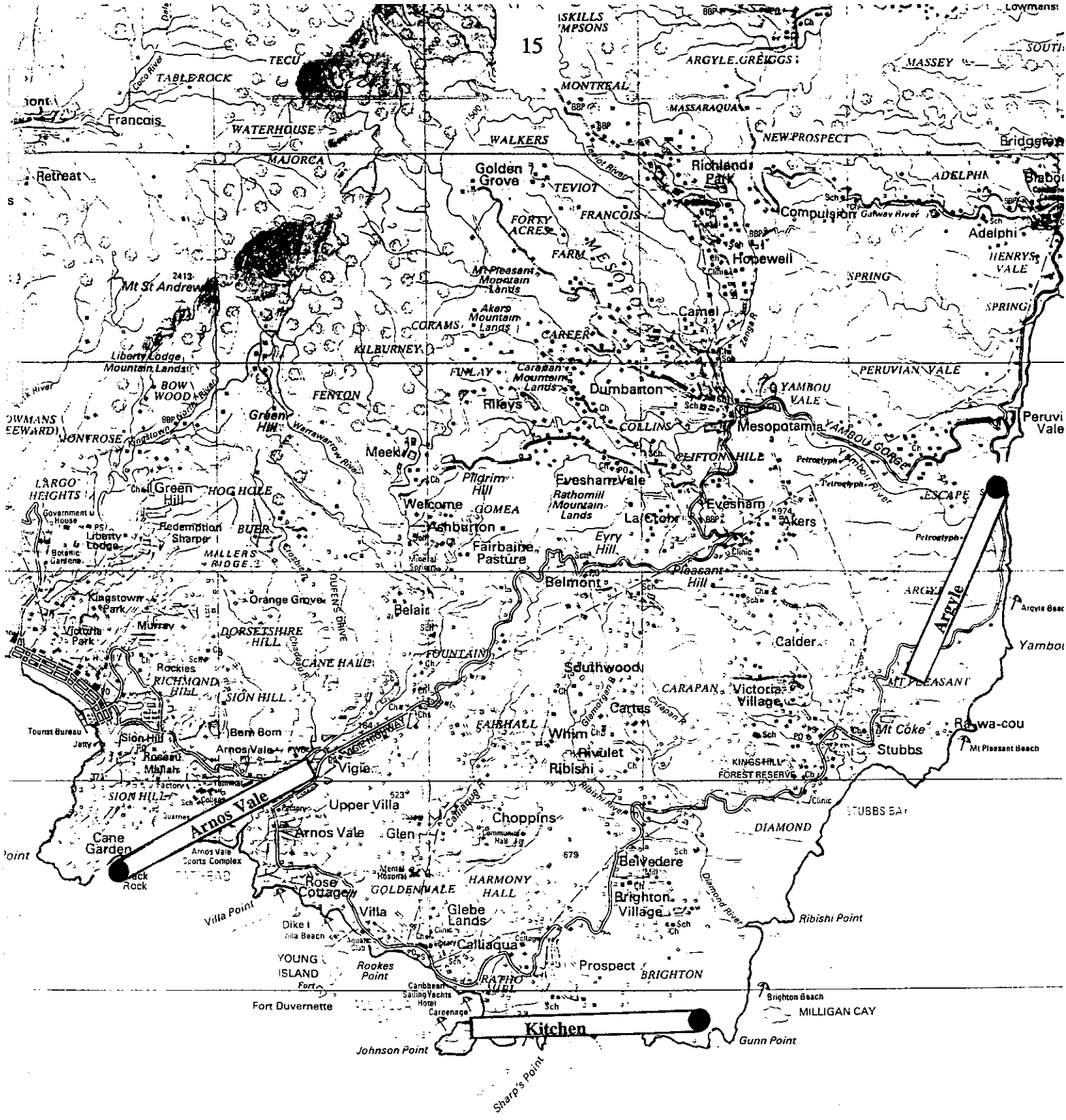

Figure 3.2 Suggested Development Options

4. DEVELOPMENT OPTIONS

4.1 Engineering Reconnaissance

Arnos Vale Site

The E. T. Joshua Airport has potential for extension of the RWY by 600 m to a length of approx. 2,000 m. Such extension can be done in reasonably shallow water, up to Black Rock. A seaward rock protection dam has to be constructed, and sand for fill below the water has earlier been located at Greathed Bay. The steep cliff to Sion Hill Bay requires excavation for clearing the approach sector. The excavated material could be used for fill above the water level.

Clearing the approach sector for a RWY strip width of 150 m involves 0.7 mil m^3 excavation, much of it in rock, and 1.4 mil m^3 fill.

Building in the vicinity of the RWY needs to be cleared, including the MoW workshop, certain building along the road to the north-west, and all buildings between the present end of the RWY and the bridge, providing a 200 m long clear zone. From the bridge, the Leeward Highway should be relocated to the hillside south. Disconnecting the Leeward Highway in this area could also be considered for development of a 300 wide RWY strip wherever possible, with a new connection following an existing road between Fontain and Rose Cottage. The Warra Warrow river requires river training, in a location parallel to the highway.

The Sports Complex is an obstacle and should be relocated in the medium term. All future buildings to the north of the RWY should clear the 300 m RWY strip recommended by ICAO (Annex 14) for instrument RWYs.

None of the improvements would however change the downwind take-off operation.

Aircraft and the respective wheelloads operating on 2,000 m RWYs are considerably heavier than HS 748 or DHL-8, and require stronger pavements. Reconstruction of the RWY pavement at Arnos Vale and the RWY extension works would require closing the airport for a lengthy period of time (six to twelve months, depending upon further studies and investigations).

Kitchen Site

A new airport at Kitchen could hold a RWY length of 2,000 to 2,500 m, involving for a strip width of 150 m, 6.1 to 6.7 mil m^3 excavation, and 3.9 to 5.2 mil m^3 fill (refer to Appendix B), either for a horizontal RWY (longitudually) or an inclined longitudinal stage at 1 per cent (acceptable under ICAO Annex 14). The RWY would be between 10 to 30 m above sea level. Developing a 300 m wide strip involves substantially more quantities, approx. 24 mil m^3 excavation. Sharp's Bay, Cable Hut Bay, Milikin Bay and Colonel Pond would be reclaimed. Sea depths are estimated to be predominantly shallow to medium, 2 - 5 fathoms. The approach on departures would be unobstructed; Milligan Cay may need cutting. The availability of sand for hydraulic fill needs further investigations.

The transitional OF2 is provided 1 : 7 as per ICAO Annex 14. Ratho Mill provides sufficient area for airside and landside development.

Argyle Site

4.3.1 This site would be a development on land only. For a RWY length of 2,000 m and a strip width of 150 m, approx. 5.5 mil m^3 excavation and 3.4 mil m^3 fill would be required, and for a strip width of 300 m approx. 8.5 mil m^3 excavation and 6.9 mil m^3 fill would be required. However, due to the topography, the RWY designation would be 04 - 22 or 05 - 23, pending conceptional designs. For light aircraft, the provision of a 700 x 18 m RWY (category 1 B) at Argyle, orientated into easterly winds, would be considered.

The main RWY would have an approach slope at 4 per cent (instead of 2 per cent as per ICAO Annex 14), and RWY elevations between 21 to 41 m (1 per cent longitudinal slope). The Argyle site has potential for airside and landside development.

4.2 Preliminary Aeronautical Assessment

Evaluation and Design Criteria used:

- Wind Rose 1969 data
- Information on longitudinal slopes of existing runway (E. T. Joshua) as per AIP information
- Maps received in scale 1 : 10,000
- ICAO, Annex 14

This evaluation is based upon aeronautical aspects, mainly the declared distances for take-off and landing and the cross and tail-wind components, which for various runway designations are critical due to the prevailing heavy winds.

The wind rose shows that over the entire year the prevailing direction is from the East. No heavy winds were observed from any other direction. Therefore, use of a runway in westerly directions is not recommended because it would almost always be with tail winds.

This evaluation serves for the safety of air navigation and the future instrumentation of the respective runways.

Arnos Vale Site

The existing physical runway is 1, 417 m in length, 45 m wide and has a strip extending 75 m to both sides of the runway centre line. Beyond RWY 07-end no strip is provided. On RWY 25-end a strip of 60 m is provided. The runway reference code according to ICAO Annex 14 is 3 C.

The declared distances are defined in Table 4.1:

Table 4.1

RWY	TORA (m)	ASDA (M)	TODA (M)	LDA (M)
07	NU*	NU	NU	1417
25	1417	1417	1417	NU

*NU = Non Usable

Take-offs from RWY 07 are critical due to the obstacles within the take-off climb surface. They are not recommended for transport aircraft with more than 5.7 t MTOW.

- Proposed Runway Extension

  RWY 07/25 may be extended by about 600 m to a total runway length of 2017 m. The extension could only be to the seaside by land reclamation.

  Calculation on the declared distances for runway 07 can only be performed after the objects which are within the take-off climb surface are defined exactly. It is assumed that after removal of various existing obstacles a reasonable runway length can be achieved for runway 25 only. After removal of some artificial obstacles and preparatory work with some natural obstacles the values in the 07 direction will not vary significantly.

  The declared distances of runway 25 after the extension are shown in Table 4.2.

Table 4.2

RWY	TORA (m)	ASDA (M)	TODA (M)	LDA (M)
25	2017	2017	2017	NU

*NU = Non Usable

- Cross-Wind and Tail-Wind Components

The wind rose provided shows that in approx. 39.9 % of the year the prevailing wind is from the 09 (East) direction with windspeeds of more than 10 kts. Without further details, it is assumed that in around 20 % of the wind is more than 13 kts.

Operating the 07 direciton, the cross-wind component is calculated to be 6,5 kts by an average wind speed of 13 kts.

For aircraft taking-off in 25 direction, the tail wind component is calculated to be 8,5 kts.

- Runway Strip

Presently, a strip of 75 m on either side of the runway cannot be safeguarded because of obstacles that should be removed.

Kitchen Site

The orientation of the proposed new runway site is 10/28, the physical length of the runway construction is 2,000 m, the strip is 2 x 150 m including 60 m before the landing threshold and 60 m beyond the end of runway. The runway code is determined to be 4 D, allowing operation of aircraft with a wing span of up to 52 m. The following considerations are based on a runway without slopes.

Declared distances are shown in Table 4.3:

Table 4.3

RWY	TORA (m)	ASDA (M)	TODA (M)	LDA (M)
10	2000	2000	2000*	2000
28	2000	2000	2000	2000

* The availability of a clearway and by that a longer TODA will be analysed in a future phase.

- Cross-Wind and Tail-Wind Components

Cross-wind and tail-wind components are not calculated because of the excellent orientation of the runway, and most probably all take-offs and landings will be in the runway 10 direction.

- Runway Strip

A runway strip of 150 m to both sides of the runway centre line should be provided. The 300 m total strip width allows instrument approaches, and will enable even precision approaches if the required landing aids (ILS or MLS) were installed. The graded points of the strip have to be maintained as per Annex 14, Attachment A, Figure A 3.

Argyle Site

The orientation of the proposed new runway site is to be 05/23, the physical length of the runway is 2,000 m, the strip 2 x 150 m including 60 m before the landing threshold and 60 m beyond the end of the runway. The runway code is then 4 D, allowing operation of aircraft with a wing span of up to 52 m. The following considerations are based on a runway without slope.

The declared distances are defined in Table 4.4:

Table 4.4

RWY	TORA (m)	ASDA (M)	TODA (M)	LDA (M)
05	2000	2000	2000*	2000
23	2000	2000	2000*	2000

* The availability of a clearway and by that a longer TODA will be analysed in a future phase.

- Cross-Wind and Tail-Wind Components

  During take-offs initiated on runway 05, the cross-wind component is calculated to be 9.95 kts by an average wind speed of 13 kts, which is 39.9 % of the year. For a 04 runway, the cross-wind component is calculated at 11.26 kts.

- Runway Strip

  A runway strip of 150 m to both sides of the runway centre line should be provided. The 300 m total strip width allows instrument approaches, and will enable even precision approaches if the required landing aids (ILS or MLS) were installed. The graded points of the strip have to be maintained as per Annex 14, Attachment A, Figure A 3.

Comparison

Tables 4.5 to 4.7 compare the sites with regard to physical runway length and usable runway length for the most appropriate types of aircraft which may operate in St. Vincent. In addition, the average seats and the possible flight distances are listed.

It has to be understood that, due to the differences in performance of jet engines and AC type, the figures as per tables 4.5 to 4.7 may vary. The runway length distances are based on maximum take-off weight. Where the required runway length with maximum take-off weight exceeds the available runway length, the aircraft have to take-off with reduced load or fuel quantity.

The wind component has been defined by using the wind rose diagram for 1969. For correct calculation the wind direction figures for at least the period of the last 5 years need to be provided from the meteorological department.

Summary

By upgrading the existing airport site and extending the runway to about 2017 m no considerable improvement has been achieved. The obstacles in the take-off climb surface from runway 07 have to be researched in detail.

Taking into consideration the areonautical requirements, the proposed sites at Kitchen and Argyle appear to be more favourable. Take-off and landing are without any obstacles. Cross wind components at Argyle site are lower than the maximum permissible components given in Annex 14, para. 3.1.2.

Table 4.5

Usable Runway Length Calculation
E.T. Joshua Airport Extension to 2017 m

AC-Type	RWY Constr. Length Physical m	RWY Length ISA+15° Slope 0% MTOW m	Required ISA+15° Average Slope 0,88% MTOW m	Seats aver.	Flight Distance Average h m
F28 MK 3000	2017	1942	2113	65	2910
F28 MK 4000	2017	1942	2113	85	1741
BAe 146-100	2017	1531	1666	88	2533
B 737-200	2017	2020	2198	130	2868
DC9-20	2017	1956	2128	90	2020
B 737-500	2017	1641	1785	132	2519
A 320-100	2017	1938	2109	173	3450
A 320-200	2017	2501	2721	150	5400
A 310-200	2017	1915	2084	280	5170
L 100-20	2017	1950	2122	n.a.	3271
A 310-200	2017	1915	2084	210	7000
B 767-200	2017	1818	1978	290	4555

Table 4.6 **Usable Runway Length Calculation**
New Airport at Kitchen Site, RWY 2000 m, Slope 0%

AC-Type	RWY Constr. Length Physical m	RWY Length Required ISA + 15° Slope 0% MTOW m	Seats Average	Flight Distance Average km
F28 MK 3000	2017	1942	65	2910
F28 MK 4000	2017	1942	85	1741
BAe 146-100	2017	1531	88	2533
B 737-200	2017	2020	130	2868
DC9-20	2017	1956	90	2020
B 737-500	2017	1641	132	2519
A 320-100	2017	1938	173	3450
A 320-200	2017	2501	150	5400
A 310-200	2017	1915	280	5170
L 100-20	2017	1950	n.a.	3271
A 310-200	2017	1915	210	7000
B 767-200	2017	1818	290	4555

Table 4.7

Usable Runway Length Calculation
New Airport at Kitchen Site, RWY 2000 m, Slope max. 1%

AC-Type	RWY Constr. Length Physical m	RWY Length ISA + 15° Slope 0% MTOW m	Required ISA + 15° Slope 1% MTOW m	Seats aver.	Flight Distance Average R m
F28 MK 3000	2017	1942	2136	65	2910
F28 MK 4000	2017	1942	2136	85	1741
BAe 146-100	2017	1531	1684	88	2533
B 737-200	2017	2020	2222	130	2868
DC9-20	2017	1956	2152	90	2020
B 737-500	2017	1641	1805	132	2519
A 320-100	2017	1938	2132	173	3450
A 320-200	2017	2501	2751	150	5400
A 310-200	2017	1915	2107	280	5170
L 100-20	2017	1950	2145	n.a.	3271
A 310-200	2017	1915	2107	210	7000
B 757-200	2017	1818	2000	290	4555

5. CONCLUSIONS

5.1 Summary

The study commenced on the 15th September, 1992, and substantial progress has been made in six key areas:

i) mobilisation and establishment;

ii) review of previous studies and assembly of planning data;

iii) analysis of airport operating environment and engineering reconnaissance;

iv) preliminary analysis of economic sectors and air sector review;

v) evaluation of alternative development options; and

vi) identification of feasible development scenarios.

The study is, therefore, proceeding as planned, and the detailing and evaluation of feasible development options can progress as programmed.

Whilst earlier studies had tended to focus on improvements at Arnos Vale versus much more expensive development of a new airport in the Kitchen area, preliminary indications are that a new facility can also be provided at Argyle and at much lower cost. Development at Argyle could also proceed incrementally, with an initial 150 metre wide runway strip which could subsequently be widened to 300 metres for an instrument runway at a later stage. Moreover, given the proposed runway alignment, and if the operations of lights aircraft prove problematic, an additional dedicated runway for category 1 B (approx. 700 m x 18 m) could be added with a more appropriate orientation.

5.2 Action by Central Planning Division

The CPD is requested to note the contents of this Inception Report, review and confirm the acceptability of the alternative airport development strategies identified for further study and more detailed evaluation, and advise the consultants of any comments as soon as possible.