
U.S. TRADE AND DEVELOPMENT AGENCY



EXECUTIVE SUMMARY

National Air Navigation Feasibility Study for the Aeroportos de Macambique E.P.

July 2000

**U.S. Firm: Advanced Management Technology Inc.
Main Contact Name: Ms. Laura Bachurski
Current Phone: 703-841-2684
Fax: 703-841-1486**

**Project Sponsor: Aeroportos de Mocambique
Main Contact Name: Mr. Jose Salomone Cossa
Current Phone: 011-258-1-465-782
Fax: 011-258-1-465-359**

**TDA Activity Number: 1999-10007A
NTIS Number: PB2001100832**

**Sector: Transportation
Region: Africa/Middle East
Country: Mozambique**

1.0 Background

In June of 1999 Advanced Management Technology, Incorporated (AMTI), was selected by the Aeroportos de Mocambique E.P. (ADM) to conduct a National Air Navigation Feasibility Study to determine the long-term development of communications, navigation, surveillance and air traffic management (CNS/ATM) infrastructure and to provide a primary source document for investment decisions and acquisitions by the ADM over the next ten years. The study was sponsored by the U.S. Trade and Development Agency (TDA). As required by the TDA, this final report substantially and comprehensively outlines the work performed by the contractor and has been approved by the ADM. The work performed under this contract was completed by AMTL

2.0 General

This study consists of six task assignments. These tasks focused on a sound understanding of the current air navigation system and the technical and financial capability of Mozambique to incrementally modernize their air traffic control system with the advanced technology of CNS/ATM. We recommended three options for ADM's consideration, conducted an assessment of current CNS/ATM technology, and recommended financial options that may be available to ADM to finance CNS/ATM equipment and installation.

3.0 CNS/ATM Feasibility Study

3.1 Task 1: Identify the status of CNS/ATM project implementation in the region and industry

In Task I of the Mozambique National Air Navigation Feasibility Study, AMTI identified and documented the international trends in Communications, Navigation, Surveillance and Air Traffic Management (CNS/ATM) on a worldwide basis and within the African Region. The discussion of international trends in CNS/ATM focused on various technologies including differential Global Positioning System (GPS), data link, aeronautical telecommunications, radar, and air traffic management systems. This task identified the barriers associated with CNS/ATM implementation and indicated how civil aviation authorities are overcoming them. AMTI provided a summary of various funding options and an indication of when and how new technology will be inserted into the transition to CNS/ATM.

3.2 Task 2: Perform site visits to assess current infrastructure of the Air Navigation System

In Task 2, AMTI made on-site assessments of the current air navigation system infrastructure in Mozambique. These assessments evaluated the strengths and weaknesses of the air navigation system and established a baseline from which the country can determine its needs for progression to a Communications, Navigation, Surveillance and Air Traffic Management (CNS/ATM) system by the year 2010. AMTI acknowledged the I country's unique geography, its concomitant geographical constraints, and the country's resulting reliance of air travel as, in many cases, the only mode of transportation available.

3.3 Task 3: Develop future infrastructure options

In Task 3, AMTI identified the CNS/ATM infrastructure options available to ADM to increase safety, capacity and efficiency in the Mozambican airspace. AMTI concentrated on the modernization and sectorization of airspace, the CNS services that should be provided, the ATM procedures that should be developed and implemented, and the establishment of a quality assurance program to ensure quality services.

This task analyzed the facilities required to implement the future air navigation system, the technologies that will be required, and the equipment that will promote the expanded use of satellite technology. Various means of surveillance including radar and Automatic Dependent Surveillance (ADS) were discussed. AMTI analyzed the present staffing requirements and provided recommendations to improve training in support of the revised manpower requirements.

This task assessed the equipment that will be part of the CNS/ATM concept and included our conclusions of the various equipment, their strengths, and their weaknesses. AMTI compiled a reference listing of suppliers, technical specifications, costs, etc.

3.4 Task 4: Develop financial options

The infrastructure options discussed in Task 3 were staged as building blocks to enable ADM to implement the level of infrastructure that is justifiable by Mozambique's economic and ADM's financial considerations. The options can be implemented gradually, enabling a practical transition from a terrestrial- to a satellite-based CNS/ATM environment for airspace users, managers and service providers.

Task 4 identified funding mechanisms available for non-avionics expenditures identified in this report, i.e. expenditures on technology and the procedures that must be developed by the air traffic service providers, airspace users, and commercial service providers. To acquire or procure the relevant infrastructure requires adequate financing for expenditures on technology and the procedures that must be developed by the air traffic service providers, airspace users, and commercial service providers. These constitute capital outlays prior to realizing operational benefits. The sources from which these funds may be made available for non-avionics expenditures are identified in this section.

3.5 Task 5: Determine the best technology options & prioritized investment plan

This CNS/ATM implementation plan represents the ADM long-term strategy for the transition from a terrestrial-based air navigation system to one that is predominately satellite-based. This plan has been developed to implement CNS/ATM in Mozambique in three phases. Implementing CNS/ATM in phases serves several purposes including:

- 1) allowing for maturing to be completed and experience to be gained before proceeding to the next level, 2) providing ADM the opportunity to implement CNS/ATM on a schedule determined by them, 3) phased-implementation does not require all elements of CNS/ATM to be operational and in place at the same time, thereby easing a potential financial burden on ADM.

The implementation will take several years, allowing ADM to build on each segment of implementation. Timelines and milestones for implementation are outlined in Appendix II. The plan is developed based on known technology, however it is flexible enough to allow for the insertion of new technology as it becomes available.

The Cost Benefit Analysis (CBA) evaluates options for investments in modernizing Mozambique's Air Navigation System. It assesses the costs of installing, operating and maintaining the new infrastructure by evaluating the benefits derived from the transition from ground-based to satellite-based systems. It also includes a prioritized investment plan with associated data, a manpower schedule with qualifications, and a list of US suppliers and manufacturers of CNS/ATM systems.

The potential financiers, some of whom were identified in Task 4, require that investment priorities are evaluated and budgetary/financial considerations are appraised. Cost contingencies need to be added, and time phasing of investments needs to be considered, as does the import content of the required financing. This is done as part of the investment plan.

This analysis determines the extent to which it would be beneficial to undertake that transition and carry out the investment options. It is conducted in three parts. Using the ICAO Cost Benefit Analysis Guidelines as a framework for the analysis of the three technology options discussed under Task 3, Part I reports on the overall results and discusses the underlying assumptions. Part II contains detailed calculations and worksheets of the analysis. It comprises one spreadsheet for each option that draws upon basic data from a fourth spreadsheet. This analysis of this data is shown on a separate spreadsheet. Part III details the expenditures in terms of recurrent and investments proposed to be carried out under each option.

As explained under Task 3, some basic infrastructure developments need to be carried out to comply with minimum ICAO standards. These are also identified separately in Part II where they are integrated with each of the options considered.

3.6 Task 6: Provide final air navigation analysis and report

The final report outlines the work performed by the contractor in a substantial and comprehensive manner and includes the comments submitted on each task by ADM. This report also highlights important issues that will affect ADM's modernization program.

This executive summary presents the major findings of the Mozambique National Air Navigation Feasibility Study. This study provides a guide for Aeroportos de Mocambique, E.P. (ADM), who manages the air navigation system, to transition from the present-day, ground-based air navigation system to a modern, satellite-based, future air navigation system known as Communication, Navigation Surveillance/Air Traffic Management (CNS/ATM). This summary, which is being presented in the form of an investment brief, provides the investor with a financial overview of this transition.