



**APPLICATIONS OF GLOBAL NAVIGATION SATELLITE SYSTEM  
TECHNOLOGIES IN SUB-SAHARAN AFRICA**

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**SATELLITE IMAGERY AND GIS AS AN INNOVATIVE  
TECHNOLOGY FOR AVIATION MANAGEMENT.**

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# Presentation Purpose



- *To show applications of Satellite Imagery and GIS in the Aviation industry*



# Contents

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- **Introduction**
- **Satellite imagery and GIS technologies**
- **Uses of satellite imagery and gis in aviation industry**
- **Recommendations**



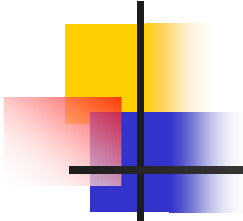
# INTRODUCTION

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Given the sensitive nature of flights, especially takeoffs and landings, airport facilities must remain at a high level of performance at all times of the year.

Furthermore, there's a lot of development activity at airports worldwide to accommodate higher capacity and stronger security without sacrificing safety and efficiency.

High-resolution satellite imagery and GIS have become innovative technologies in airport development, management and maintenance.



**These tools, because of their ability to integrate airport data and socio-economic data, are valuable tools and powerful decision support system for the airport infrastructure management.**

**Airport managers over the years, have turned to the use of satellite imagery and geographic information system to support their efforts in planning, operations, maintenance, and security.**

**Airports around the world plan for and manage their facilities by integrating Satellite imagery and GIS with many other information technology tools.**

The satellite imagery and GIS technologies have made it possible (where utilized) for airport resource planners to easily produce a combination of maps, graphs and tables that shows:

- "Where" (location),
- "What" (kind)
- "How much" (quality/limitation) of resources
- "What has changed since" (trends)
- "What spatial patterns exist" (patterns)
- "What if".

# SATELLITE IMAGERY AND GIS

## TECHNOLOGIES

There have been series of physical developments within and around our airports. Some of these developments, which include settlements, villages and hamlets around the airports and on the airline routes need to be monitored with planned maintenance policies and programmes.

- In other words, the maps covering our airports and their environs are completely outdated and can no longer serve the purposes of which they were produced.
- Most airports, the Federal Airport Authority of Nigeria (FAAN) for instance, have a large number of data sources but are hampered by their inability to combine them in a meaningful way.
- There is the need therefore, for management support tools that will provide information to aid decision-making. Worldwide Satellite imagery and GIS have been identified as the technology that brings about these desired results.



# Satellite Imagery

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Satellite imagery is a product of remote sensing techniques for map production.

Satellite imagery can also be defined as the acquisition, and interpretation of images from space. These images can be Low Resolution or High Resolution images.





# Types of Satellite Imagery

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- Low Resolution Imagery

- LANDSAT
- Nigeria SAT-1

- High Resolution Imagery

- DIGITAL GLOBE/QUICKBIRD
- SPOT
- IKONOS



# Low Resolution Imagery

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## **Landsat 7**

- It was launched successfully on 15th April 1999.
- It is an ideal, multi-purpose, cost-effective tool for a huge range of applications.

## **NigeriaSat-1 Satellite**

- NigeriaSat-1 was launched in 2003
- Groundstation is located in Abuja, Nigeria
- Site selection and survey has been completed
- Installation commenced in May, 2003.

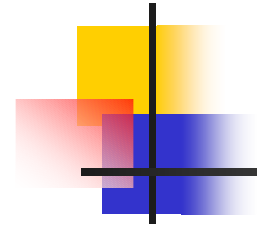


# High Resolution Imagery

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## 1. Digital Globe/Quickbird:

- This satellite provides the greatest collection capacity and largest image size commercially available.
- Its key advantage is the ability to obtain imagery for nearly all parts of the world in short time frames.



## **2. SPOT**

**The SPOT 5 was launched on the May 4th 2002**

**Its advantages includes:**

**Better ground resolution**

**Repeat coverage every five days**

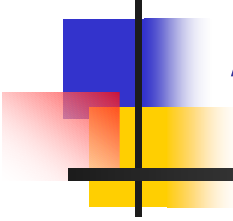
**An elevation accuracy of 10 metres.**



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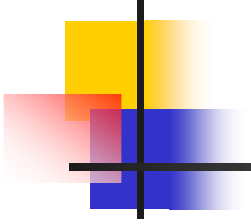
### **3. IKONOS**

- **Provides a reliable stream of image data that has become the standard for commercial high resolution satellite data products.**

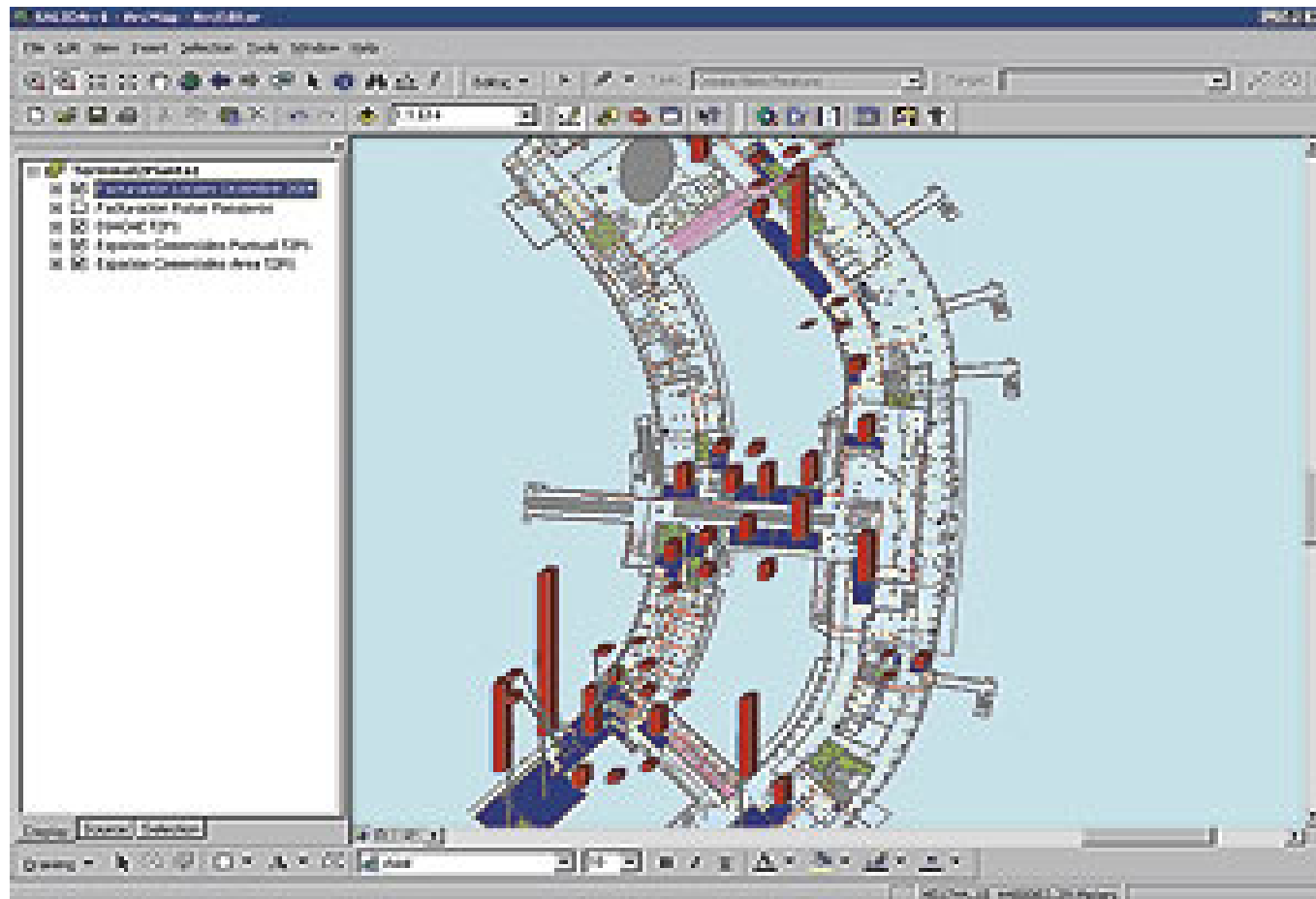


# Typical Examples of Some Airports Satellite Imageries

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# Spanish Airport Authority





# Brussels International Airport





# GEOGRAPHIC INFORMATION SYSTEMS

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- **A GIS is a software package, that contains unified sets of tool and concepts for handling and displaying spatial information in the computer.**
- **With GIS, information captured in digital aerial photographs can be registered geographically. This provides excellent background layers for mapping applications.**
- **GIS provides a powerful analytic capability for understanding vulnerability in existing facilities as well as in pinpointing trends in incidents.**
- **The GIS technology can also tie incident log information directly to the exact location in the airport's facility.**



# GIS Suite of Products

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- There are so many GIS suite of products in the market, but the global leader and the most popular in the Aviation industry are the Environmental Scientific Research Institute (ESRI) USA products.



They include:

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### **ArcGIS 9:**

This is an integrated collection of GIS software products for building a complete GIS for Aviation industry.

It can be used on desktops, on servers, over the web, or in the field.

### **ArcGIS Desktop:**

This is a geo-processing framework for modeling, scripting and managing aviation work flows. Its functions include annotation and labeling enhancements, Improved raster management and much more.

### **ArcGIS Extensions:**

These make it easy to add new features to ArcGIS. They are plug-ins that users can load and unload, as they need them.

### **Internet Map Server e.g ArcIMS**

This is a server-based product for internet map servicing that will help aviation user acquire different maps and over-lay them on one another in order to generate own maps and images.

It provides a scalable framework for distributing GIS services and data over the Web.



# Applications of Satellite Imagery and GIS in Aviation Industry

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- Facilities Management
- Capital Planning
- Property/Lease Management
- Land Acquisition
- Security and Risk Assessment
- Flight Path Management
- Airport Layout Planning
- Pavement Management
- Parking Management
- Courtesy Vehicle Management
- Utility Maintenance
- Lighting Management
- Noise Monitoring and Modeling
- Disaster Management
- Environmental Assessment.

# **USES OF SATELLITE IMAGERY AND GIS IN THE AVIATION**

**INDUSTRY**



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## A. Portland International Jetport

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### ⑩ Digital Mapping of Airports

The QuickBird satellite imagery combined with a GIS, was used to map airport features. It was also used to identify urban growth patterns that can constrain future airport development.

### ⑩ Airspace Planning

Commercial airlines and air traffic control regulators use GIS for airspace planning and routing applications and for facilities management applications. Recent enhancements to three-dimensional GIS allow more advanced airspace modeling applications to be combined with geographic information from local communities such as parcels, land use, building heights, new construction, and modified terrain around the airport.



## B. International Air Transport Association (IATA)

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- In 2004, IATA signed an exclusive agreement with a satellite imagery producer to increase air transport safety and efficiency for airlines and airports.
- This satellite imagery for airports includes visual representations of ground obstacles. Aeronautical terrain and obstacle databases, and Airport Mapping Databases (AMDB) that conform to the aviation industry's international standard.





## C. Spanish Airport Authority

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- The SAA adopted ESRI software (ArcSDE, ArcIMS, ArcGIS, and ArcPad) for the AENA corporate GIS across its enterprise, which will be implemented by the Department of Infrastructure Planning and Information Technology (IT) as part of the agency's Airport Information Management System.
- The result will be a set of GIS applications that support the Airport Information Management System for 47 airports across the whole of Spain.
- Beyond these traditional applications, AENA will support commercial operations at the trading areas inside terminals, such as best location for advertising depending of passenger routes, retail and concessions management, billing control, and revenue analysis per trading area. ESRI GIS-based applications will also support material handling activities around platforms, such as best location for information points and equipment inventory.



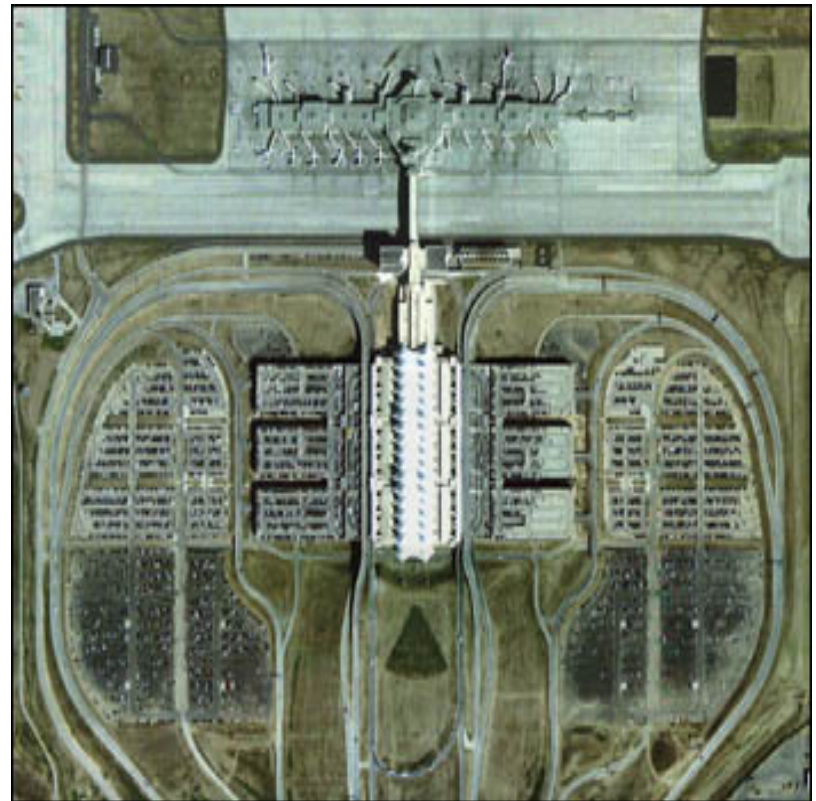
## D. Brussels International Airport Forms Evacuation Scenarios With GIS

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- Brussels International Airport is a busy place, it's like market day in a small town. When dealing with the development of evacuation scenarios, it's also a place where three imperatives meet:
- **Continuity**—Planes can't just wait to land if an alarm goes off, passengers hate delays, and concessionaires don't want their shops closed.
- **Containment**—Security considerations mean restricting access, and business considerations mean any disruption has to be restricted to the smallest possible area.
- **Free movement** — Airport users have to feel comfortable, and during an incident they have to reach a safe evacuation zone as quickly as possible.
- Drawing up fire or evacuation scenarios that balance these conflicting requirements is no trivial task. These scenarios define the airport's response to any incident, and in order to facilitate response GIS technology is currently being used.

## E. Denver International Airport (DIA)

- DIA is one of the largest airports in the world; the airport's management monitors its many-layered infrastructure through a series of online models and GIS maps.





# RECOMMENDATIONS

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- **Satellite imageries and GIS Technology have relevance to the Airport and Infrastructure Management as applicable in other countries. They can be used for the **Production of Digital Mapping of Airports, Gazetteer of Place Names for Disaster Management and Digital Airport Database.****
- **Aviation professionals the world over have discovered and embraced satellite imagery GIS as an important tool in managing, planning, evaluating, and maintaining aviation infrastructure using GIS. It is highly recommended that the Sub Sahara African Government should embrace the satellite and GIS technology for our airport management as it is being done in other countries.**



# CONCLUSION

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- With Satellite imagery and a complete suite of GIS products, aviation users can provide all the functionality for creating and managing an Intelligent Aviation GIS for safety, quality assurance and reforms in the institutional and capacity building as a consensus for effective aviation reforms.

