Earth Observation Satellites – Dawn of Application Specific Satellite Data

Date: 26 July 2017
Introducing a World of New Possibilities

- Satellite imagery is a critical fountain of information on all levels of the economy – **linking scientific facts with visual proof**

- Satellite ownership is not a far fetched dream but a realistic instrument that **ensures operational independence**, security and privacy in a country

- Space technology grows exponentially through **products derived from imaging satellites** orbiting our earth
**Facts**

- Satellites play a substantial role in the **economical development, policy making and informed decision making** needed to productively manage a country’s resources.

- **Complex decision making:**
  - **Economic Growth**
    - Urban Planning, Infrastructure Management
  - **Environmental Management**
    - Agriculture, Mining, Forestry
  - **Security**
    - Food, Borders, Regional / National
  - **Disaster Management**
    - Fire, Storms, Floods

**Satellites Easy to Task, Quick to Respond, Cover Large Areas, Daily and Frequent Revisits Without Any Restrictions**
Spatial Resolution - Level of Information Contained in an Image

- The higher the resolution the more information captured
- Aircraft and now Drones flying at low altitudes - image resolution is higher typically sub meter to within 1 to 2 centimetres
- Compromise on the size, Aircraft mainly providing a micro level management tool - small swath
- Satellites have lower resolution but can collect exponentially more ground in much quicker time - including thousands of square kilometres in a single image - macro management

Satellite imagery can be grouped into three levels of resolution:

- **Medium Resolution**
  - 30m – 100m
- **High Resolution**
  - 1.5m – 5m
- **Very High Resolution**
  - 0.30cm – 1.0m
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Basic Imagery Products

- Original
- Radiometric Correction
- Geometric Correction

- Precise Geometric Correction (+DEM)
- Ortho Correction (+external GCP’s)
Imagery Products: Mosaic

Pan-sharpened Mosaic
Imagery Products: Digital Elevation Models

Radarsat-2 30m
Digital Elevation Models

PlanetDEM 30
Digital Elevation Model

Sinergise 3D Viewer
Digital Elevation Model
Applications

• An affordable source of information for analysing, monitoring, forecasting and managing resources and human activities on the planet

• True decision-support tools for a range of applications such as:
  • Agriculture
  • Forestry
  • Energy
  • Environmental
  • Intelligence
  • Mapping
  • Maritime
  • Mining
  • Transportation
  • Urban and Rural Development
  • Disaster Management
Applications: Agriculture

- Crop Identification / Type
- Crop Health
- Crop Yield
- Crop Insurance Assessments
- Drought Assessments
- Grazing Management
- Livestock Stocking Rate, Grass Availability, Overstocking Risks
- Statistic accuracy > 95%

Precision Farming

- NDVI (Normalised Differential Vegetation Index)

Chlorophyll volume changes as crop’s mature and if the crop undergoes any stress related to nutrition, water or pests
Applications: Forestry

- Forestry industry uses satellite imagery to monitor forests at stand level across the African Continent...
  - Fire Prevention/management
  - Identification and Monitoring
  - Forest Health and Risks
  - Forest Management
  - Timber Inventory
  - Deforestation
Applications: Disaster Management

- Natural disasters increasing in number and frequency, and affect most countries in Africa
  - Droughts
  - Floods
  - Wildfires
  - Wind
- Satellite imagery provides a set of unique resources to **detect, monitor and assist** in managing natural and man-made disasters.
Disaster Management: Fire Fighting

- Satellite imagery and GIS maps support fire and emergency personnel responding to emergency situations, hazardous fuels reduction, community assistance, firefighting, rehabilitation, and restoration.
Disaster Management: Fire Knysna - 2017
Applications: Environment

The African Continent faces many challenges and suffers from some serious environmental problems, which have been worsened by the advent of climate change...

Remote sensing and development of different sensors for environmental and natural resources mapping and data acquisition are critical in managing the threats to the environment...

- Land Use and Land Cover
- Impervious Surface
- Water
- Soil Erosion
Urban Growth

- Cities grow exponentially, ever increasing the demand on public services and increasing the demand on disaster planning.
- **De-vegetation and soil sealing** increase flood risk.
- With regular satellite imagery **change detection**, urban growth can be managed in conjunction with flood models, digital elevation models, precipitation models, catchment area maps.
  - Data overlaid with census and population growth models.
Environment: Water Quality

DEIMOS-1 Satellite Imagery

Natural Color (RGB)

False Color (R,G,NIR)

Chlorophyll-a

Seston

Secchi Disk Transparency
Environment: Water Management

- Droughts put significant **strain on groundwater**, which can lead to land sinking and causing significant damage to infrastructure, agriculture, mining, etc.

- Sinking land, known as **subsidence**, occurs because of excessive groundwater pumping during drought conditions.

- Radar satellite imagery data used to measure the subsidence in the ground revealed the sinking happening faster due to the severity of the drought in the region.
Mining: Management and Operations

Satellite imagery used to manage day-to-day operations of mines, mineral extraction and maintenance of infrastructure...

- Find an optimal venue for the drilling according to **the location of infrastructure** objects as buildings, roads, pipelines, water and utilities.

- **Control the process of compliance with environmental standards** for planning and realization measures to control air pollution, soil and water.

- Assess the extent of the **impact of work on the environment** and the progress of work on land reclamation in accordance with state standards.
**Application: Maritime**

- Water represents 70% of the world's surface area, but only 0.6% of the surface is protected surface area.
- 60% of the world's population lives by the sea.
- $50 billion: Annual cost of poor management of fisheries.
- 50% of the oxygen we breathe is produced by the oceans.
- 75% of major global fisheries have been overexploited or already depleted.
- $2500 billion per year come from the sea (fishing, underwater research, tourism, maritime transport).
- $10-23 billion: Annual cost of illegal fishing.
- 90% of Africa's imports and exports conducted by sea.
- >$100 billion: Worth of oil has gone missing since 1960.
- 38 African countries are coastal.
- 1/5 of Pirate attacks take place in the Gulf of Guinea.
- 4.1% estimated annual decrease in bulk goods shipped due to maritime insecurity.
- 1 attack per week: Average number of pirate attacks in the Gulf of Guinea.
- 20 million tonnes in 1960, 150 million tonnes today.
EEZ Monitoring

- Satellites only resource capable of conducting broad ocean surveillance of the continents EEZ’s to fully understand the threats to regional economic security...
  - Satellites capable of:
    - **Monitoring ship traffic** along coastlines and in open oceans
    - Combating **illegal fishing, piracy, human trafficking, smuggling and terrorism**
    - Supporting operational requirements such as search and **rescue and salvage** and recovery

- Each vessel detected reported by:
  - Type (Optical Data)
  - Geographical Location (Latitude/Longitude)
  - Vessel Dimensions
  - Heading
  - Speed

- By combining the satellite based information with other available sources such as AIS, non-reporting and noncompliant vessels highlighted, monitored and reported to the appropriate authorities.

30m Multispectral Landsat-8 Satellite Imagery
Environmental Protection

- Environmental protection and enforcement supported by both synthetic aperture radar and optical satellites
  - Port and Harbor Monitoring
  - Law Enforcement - Piracy
  - Oil Spills

1.0m Pan-sharpened (Colour) IKONOS Satellite Imagery
Gulf of Mexico

IMB Piracy & Armed Robbery Map 2015
Cadastral Mapping

- Cadastral mapping requires the use of very high resolution satellite imagery to create an accurate base map of each country...
- Satellite imagery is used to develop the foundation of a national cadastre and title registry system

- Image processing
- Ortho-rectification
- Feature extraction
- Land cover
- Change detection
3D City Mapping

- Satellites used to generate high resolution building models from stereo imagery, which is the basis of creating 3D Smart Cities...

  - Urban Planning and Analysis
  - Economic Development
  - Transportation
  - Flood Modeling
  - Line-of-Sight
Application: Defense and Intelligence

Unrestricted access to targets only provided by commercial satellites to address needs of defense and intelligence organizations…

- Installation Classification
- Indications and Warning
- Terrain Analysis
- Mission Planning and Rehearsal
- Camouflage, Concealment and Deception
- Mapping, Charting & Geodesy
- Intelligence, Surveillance and Reconnaissance
SCS Gi in association with its suppliers are offering

Africa Satellite Constellation with Unparalleled Response to Users Needs
Application specific satellite option

SCS Aerospace Group of company’s provide commercial satellite solutions
- The opportunity to implement application specific satellites
- Custom developed for business specific application
- Cost effective compact satellite solution

- **nSight1** is a shoebox size satellite with:
  - 30m resolution
  - RGB technology
  - 60 x 30 km snapshot

- Applications
  - Food security
  - Water management
  - Forestry
  - Environment

- Be sure to attend our press conference later this morning
- Hendrik Burger CEO SCS-AG will be available for questions