Satellite Imagery Analysis

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image: nasa.gov
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Be sure to photograph EFF attorneys

"I could certainly foresee circumstances in which we would not want imagery to be openly disseminated of a sensitive site of any type, whether it is here or overseas,"

- Robert Muttett, director National Geospatial-Intelligence Agency

“With the help of about $1 billion from Murrett's agency, the companies [DigitalGlobe GeoEye] plan to launch new satellites with higher resolutions later this year.”

“While the public will begin to see crisper images online and elsewhere, government regulations will require the companies to degrade the quality of the imagery to a half-meter resolution.”

Imagery Analysis

- Understand capabilities and limitations of sensors and platforms
- Image quality and realistic expectations
- Build smart books
- Combine multiple sources and times
- Seek out domain experts
  - Collaborative analysis
- Combine with other forms of information
- Reverse engineering a city
- Watching the watcher
- A look to the future
Keplerian Elements

• Epoch
• Orbital Inclination
• Right Ascension of Ascending Node
• Argument of Perigee
• Eccentricity
• Mean Motion
• Mean Anomaly
• Drag (optional)

http://www.amsat.org/amsat/keps/kepmodel.html
Example of Imagery Sat Keps

- Commercial imagery sat (graphic that builds using keps)
- Source of satellite keps
- Demo of Nova for Windows
Space Craft Orbits

LEO

HEO

GEO

image: http://www2.uma.maine.edu/faculty/rsm/slides/chap11/f11-6.gif
Typical Satellite Orbits

- **Geosynchronous Orbit (GEO)**
  - Missile Warning (US)
  - Communications

- **Molniya Orbit**
  - Missile Warning (Russia)
  - Communications

- **Semi-Synchronous Orbit**
  - Navigation
  - Nuclear Burst Detection (US)

- **Low Earth Orbit (LEO)**
  - Photoreconnaissance
  - Ocean Surveillance (Russia)
  - Electronic Surveillance (Russia)
  - Communications (Russia)
  - Navigation
  - Meteorology


http://www.ndu.edu/inss/books/Books%20-%201998/Military%20Geography%20March%201998/mgmap30.gif
U.S. and Soviet Space Launch Sites and Control Centers
UAVs

- RQ-1 Predator
- Predator B (jet powered)
- RQ-2 Pioneer
- RQ-4A Global Hawk
- BQM-147A Exdrone (Dragon Drone)

see stats and images here...

Other Platforms

Global Hawk
Source: Teledyne Ryan Aeronautical Inc.

https://wrc.navair-rdte.navy.mil/warfighter_enc/aircraft/UAVs/GHawk.htm
Resolution

source: http://www.fas.org/irp/imint/resolve2.htm
Rotate Image to Vantage Point of Observer
Orient Yourself to the Location
Orient to North

image: http://www.mapquest.com
http://en.wikipedia.org/wiki/Runway
Parking
Aircraft Identification

Cessna Citation II

Gulfstream IV

Lockheed WP-3D Orion

Lake Seawolf (LA-27)

http://www.aoc.noaa.gov/
Unique Aircraft Identification

Serial Number: 550-0021
Type Registration: Government
Manufacturer Name: CESSNA
Certificate Issue Date: 01/26/1988
Model: 550
Status: Valid
Type Engine: Turbo-Jet
MFR Year: 1978

N-number inquiries: http://registry.faa.gov/aircraftinquiry/NNum_inquiry.asp
Kazan Helicopter Plant

http://www.kazanhelicopters.com/index.php?id=4
MiG-35 at Aero India Airshow

Graveyards...
Antennas

Yagi

Cell Towers

Microwave

Parabolic Reflector / Satellite Dish

See notes section for image citations
Example: Bridging
Bridging

Trestle Bridge

Arch Bridge

Bridge Under Construction

Draw Bridge

http://en.wikipedia.org/wiki/Bridg
Bangalore, India

http://maps.google.com/
Yelahanka Air Force Base

http://maps.google.com/
Anonymization
Selective Obscuration
Conclusions

http://rapidfire.sci.gsfc.nasa.gov/gallery/2005292-1019/Wilma.A2005292.1640.250m.jpg