



National Authority for Remote Sensing and Space Sciences

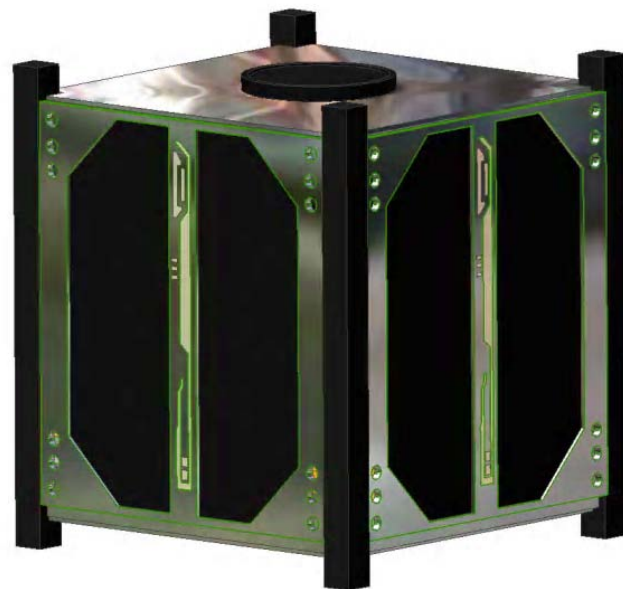
Design and Implementation of a Pico Satellite



Egycubsat-1

The First Egyptian NanoSatellite

Prof. Dr. Amal Zaki
Prof. Dr. Ayman EIDessouki





Egycubesat-1 Project

National Authority for Remote Sensing and Space Sciences

Is the organization responsible for the Space activities and remote sensing research in Egypt

.NARSS is part of the Ministry of Scientific Research in Egypt.

Remote Sensing activities started in Egypt since the 1970's.

NARSS was established in 1991.

NARSS is composed of 8 scientific divisions and is also implementing the Egyptian Space program.



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VISION

•NARSS is looking forward to become one of the best scientific agencies locally, regionally, and internationally for conducting research and providing services in the field of remote sensing and space sciences in order to support decision makers and researchers in different sectors of the development plans of Egypt.



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MISSION

•NARSS mission is to pursue, transfer, and provide the most modern technology in the fields of Remote Sensing and peaceful applications of Space Sciences, and build the self-capability of utilizing these technologies to support the National development plans and objectives

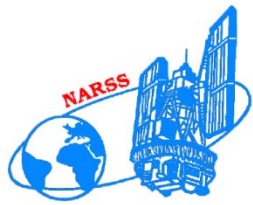


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NARSS International Cooperation

- **NARSS pays a great attention to cooperation with both Arabic and foreign countries. This is accomplished through participating in conferences and workshops and signing of scientific cooperation agreements.**
- **NARSS participates in the international scientific conferences to exchange experience with scientists worldwide, and takes part in the international projects of the Egyptian Academy for Scientific Research and Technology**

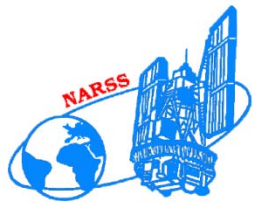


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NARSS International Cooperation

- **NARSS has relations with more than 44 countries (Italy, UK, Germany, Japan, USA, South Africa,..) and international and regional organizations.**
- **NARSS participates in Projects submitted to the EU, US-Egypt Joint Fund, and other similar programs.**
- **NARSS is implementing a space project in cooperation with Ukraine resulting in launching of the first Egyptian satellite and cooperates with different foreign countries in the field of peaceful use of space**



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Elements of the Egyptian Space Program

- Egyptian Space Program 1997 – 2017:
 - First Egyptian Satellite EgyptSat-1:
 - Designed and manufactured in Ukraine with Egyptian Participation (2002-2007).
 - Second Egyptian Satellite EgyptSat-2:
 - Establishment of know-how and technology with much less foreign technical assistance (2007-2013).
 - The third Egyptian satellite DesertSat:
 - Egyptian design and manufacturing with limited foreign technical assistance (2012-2017) utilizing Radar Technology.
 - Establishment of assembly testing and development labs.
 - Human Resource development.
 - Establishing relationship with R&D centers, industrial centers and universities.
 - Nano Satellites & cooperation with universities



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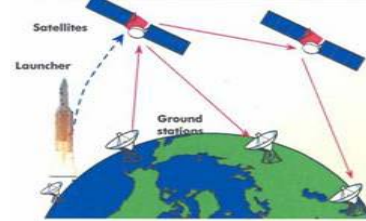
Space Labs



Transfer of Technologies

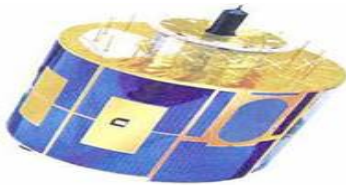


Ground Stations



Components of Egyptian Space Program

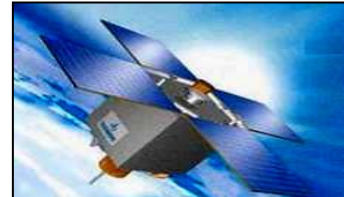
Desert Sat



EgyptSat-2



EgyptSat-1





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**Control
Station**





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Control Station

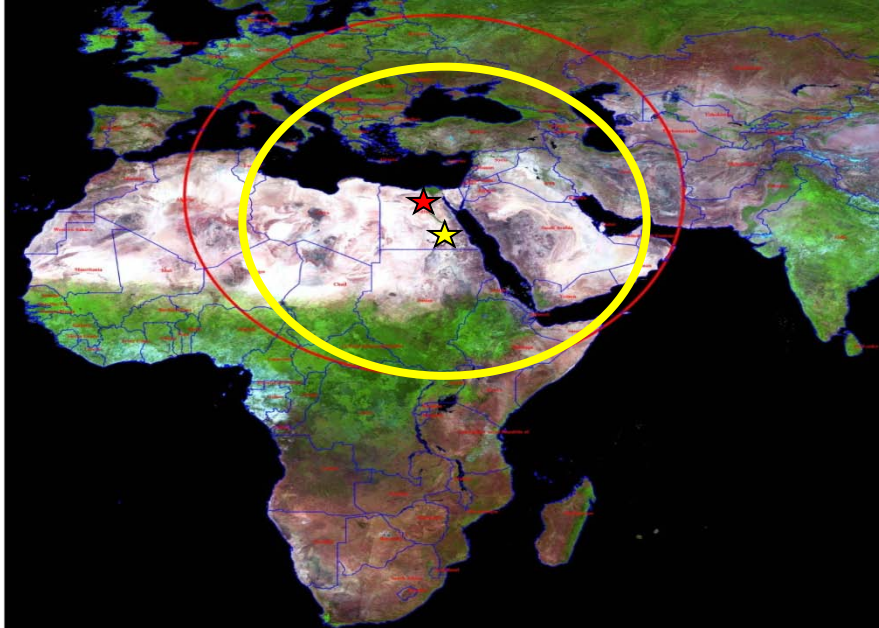




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Data Receiving Station





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Space Labs

- PayLoad Lab.
- Design Office Lab.
- Engineering Model & Checkout Equipment Lab.
- Manufacturing Components Lab.
- Communications Lab.
- AIT Facility



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Payload Lab.

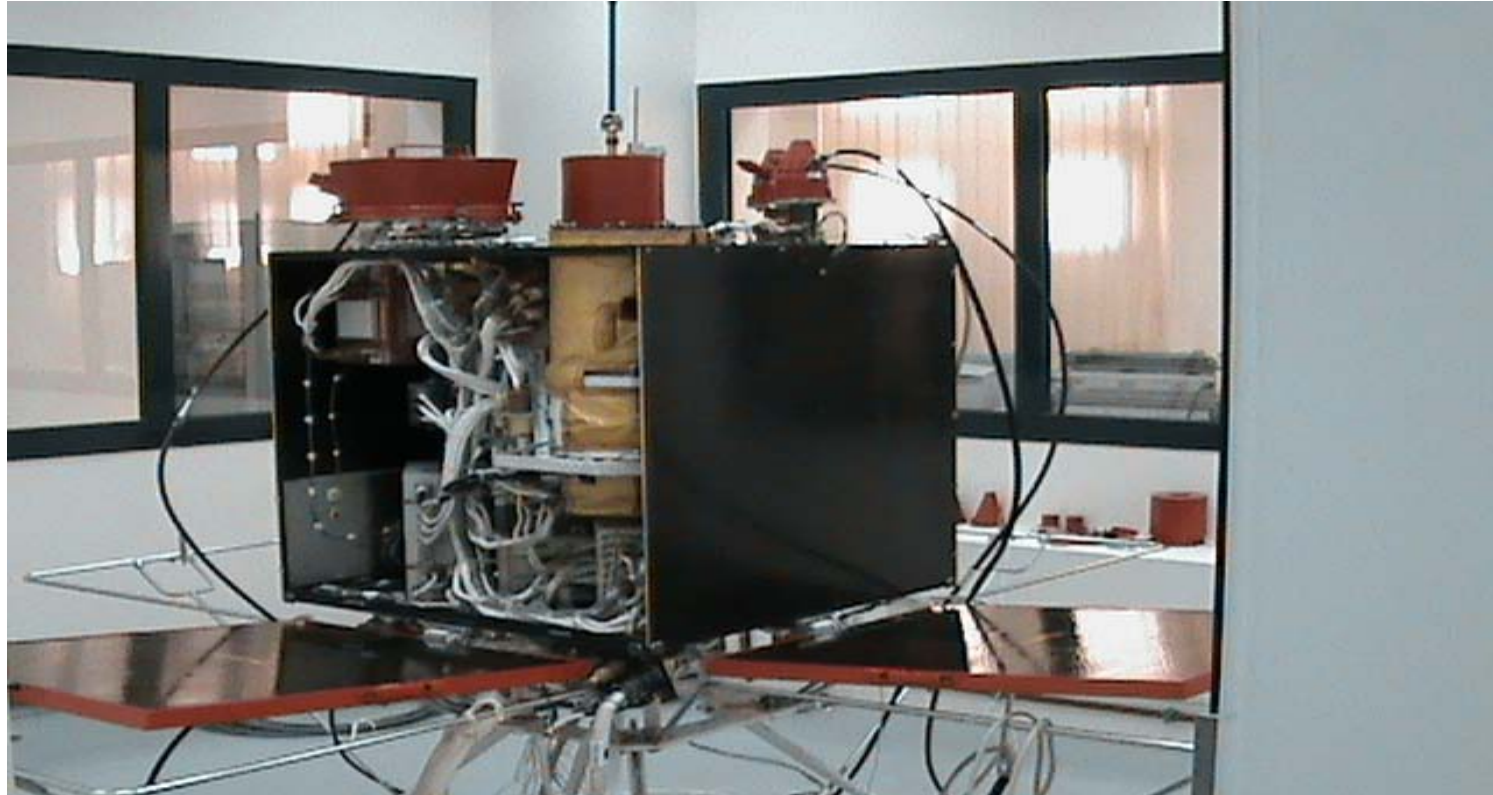




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**Engineering
Model Lab.**





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**Checkout
Equipment**





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Human Resources

- The staff of the ESP is formed of 120 specialist:
 - 15 Ph.D's
 - 50 Design & R/D Engineers.
 - 40 Engineers and Technicians for operating ground segment stations.
 - 15 Supporting Technicians.

Resides Administration and Support Staff



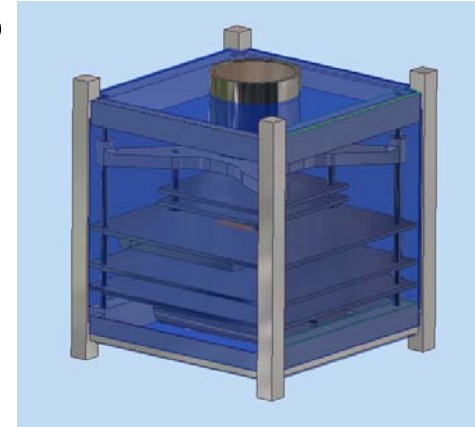
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Sponsors



Egycubesat-1 mission Goals:

- To place Egycubesat-1 on the space map
- Technology demonstration to show Egycubesat-1 can produce reliable data from space
- Promote the applied research in space engineering in the Egyptian universities and research Institutes.





Egycubesat-1 Project



Partners



Launch Providers

- Launch Services from MHI.
- H-2A F17 LV
- J-POD From JAXSA





Egycubesat-1 Project

Partners



Egycubesat-1 General Specs

- 1Kg Mass
- 10 Cm Cube
- PL, Camera with GSD better than 100m
- snapshots for Egypt territories
- sun synchronous and LEO orbit
- Altitude is ranging from 600-700 Km
- Expected life time is six months
- All components are COTS



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Partners



Concept of Design:

□ Performance

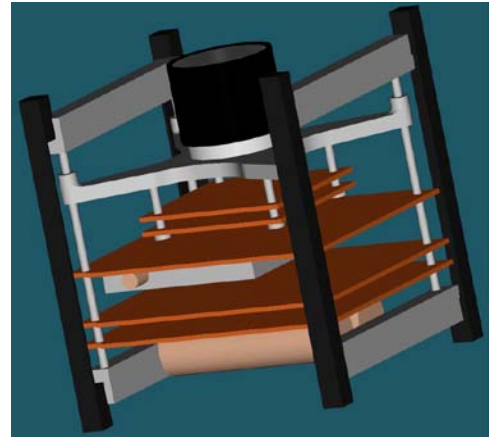
- Low power, mass, volume
- Withstand thermal, vacuum, and space radiation.
- Low cost components for earth observation.

□ System integrity

- The mechanical and thermal integrity

□ Subsystems interfacing compatibility

- compatible with the standard CubeSat Kit





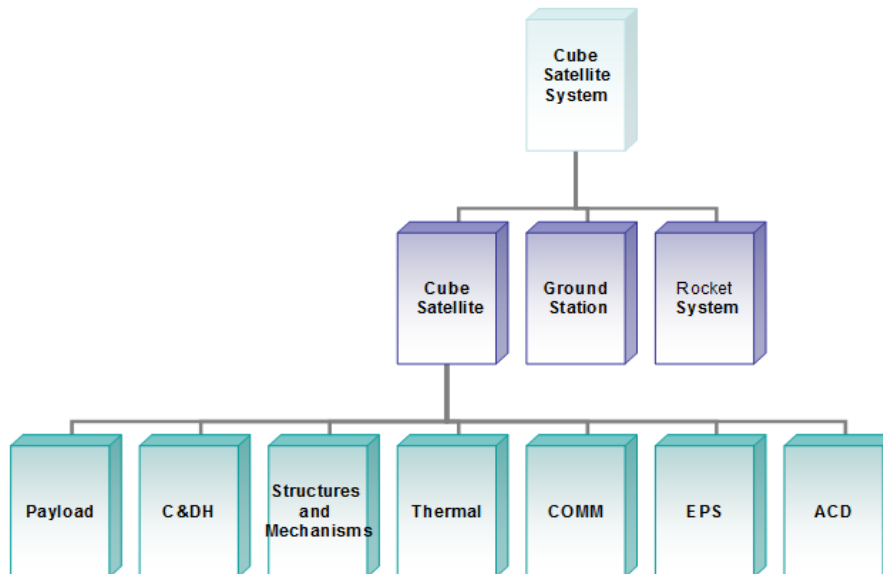
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Partners



Egycubesat Subsystems





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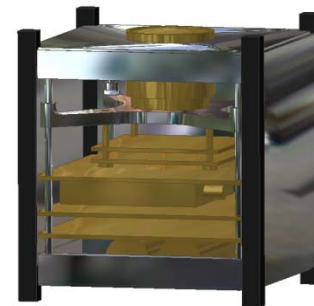
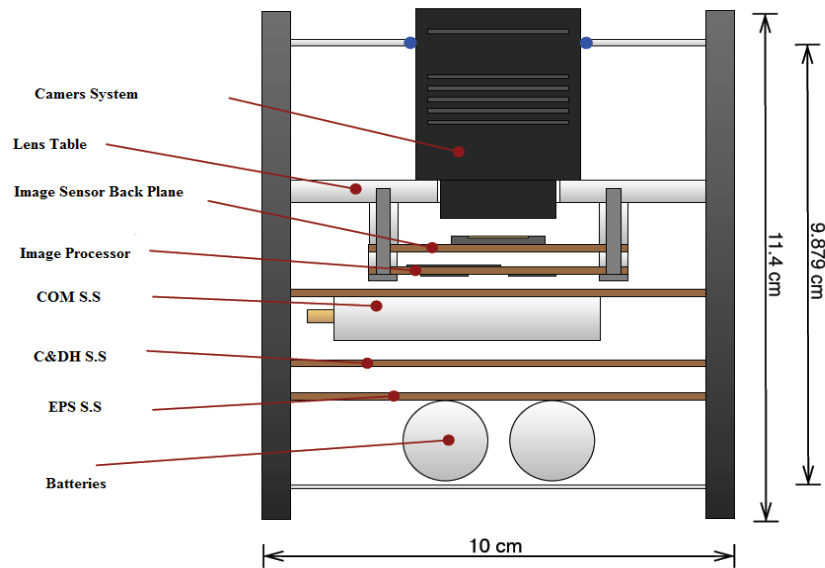


Partners



Internal and External Configuration:

Internal Configuration



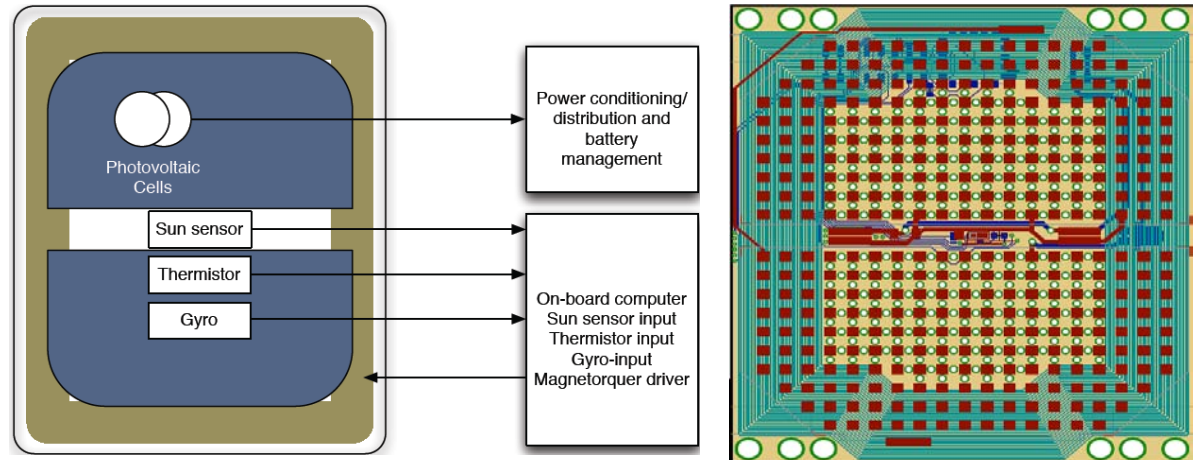
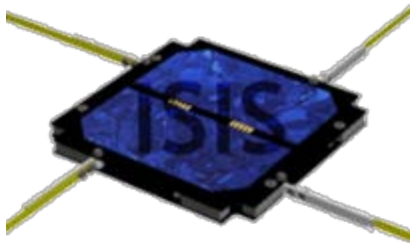


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□ External Configuration

- Antenna System
- Solar panels
- ADCS components

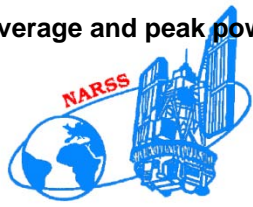




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Subsystems Mass Budget

Subsystem	Mass (g)	Percent of total
<i>Payload</i>	197	19.7%
<i>ADCS</i>	60	8%
<i>C&DH</i>	56	5.6%
<i>Power</i>	262	26.2%
<i>Communication</i>	120	12%
<i>Structure & Mechanism</i>	240	24%
<i>Thermal</i>	30	3%
Total allocated	965	96.5%
Margin	35	3.5%
Total Mass	1000	100%



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Subsystem Power Budget (During Image)

System	Peak power during imaging (mW)	Average power during orbit (mW)
ADCS	275	285
CDH	250	250
COMUNICATION	2000	210
EPS	300	300
PAYLOAD	0	20
TOTAL	2825	1065



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Subsystems Power Budget (During Image download)

Subsystem	Peak power during image download (mW)	Average power during orbit (mW)
ADCS	275	275
CDH	250	250
COMUNICATION	2000	370
EPS	300	300
PAYLOAD	430	40
TOTAL	3255	1235



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ORBIT ANALYSIS

Launching opportunity imposes sun-synchronous orbit with altitude between 600 and 700 km.

Altitude	600 km	650 km	700 km
Semi-major axis (km)	6978. 14	7028. 14	7078 .14
Orbit draconic period (sec)	5801. 23	5863. 69	5926 .38
Eccentricity	0.0	0.0	0.0
Inclination (°)	97.79 24	97.99 08	98.1 928
Longitude of ascending node	22:00: 00	22:00: 00	22:0 0:00

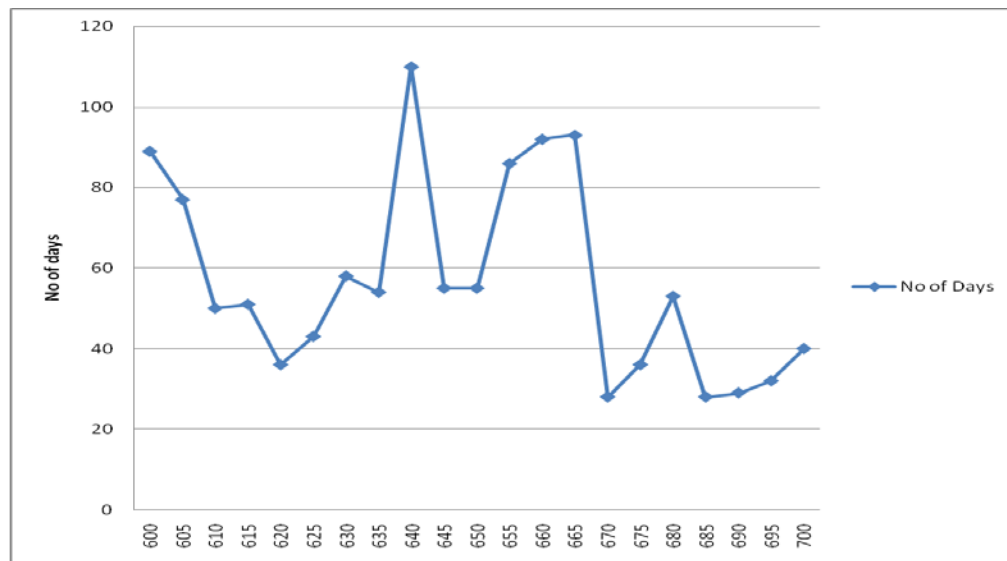


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These orbital parameters will allow the following:

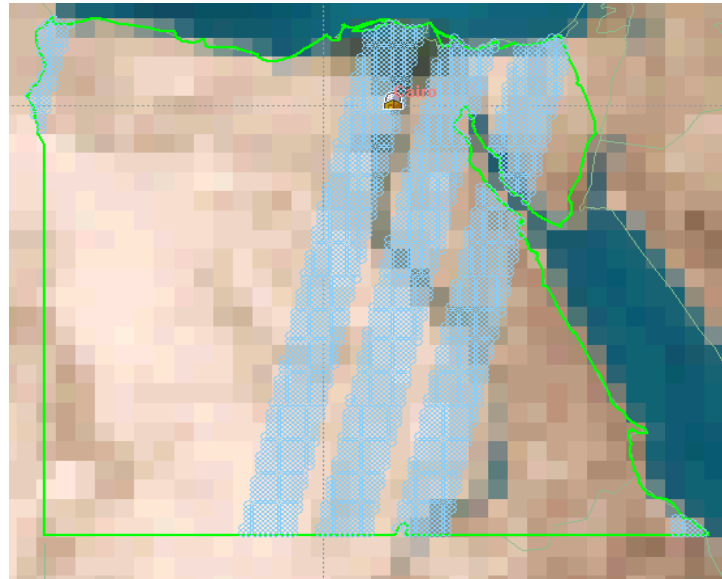
- Revisit time



Number of days for full coverage of Egypt territories against orbital altitude



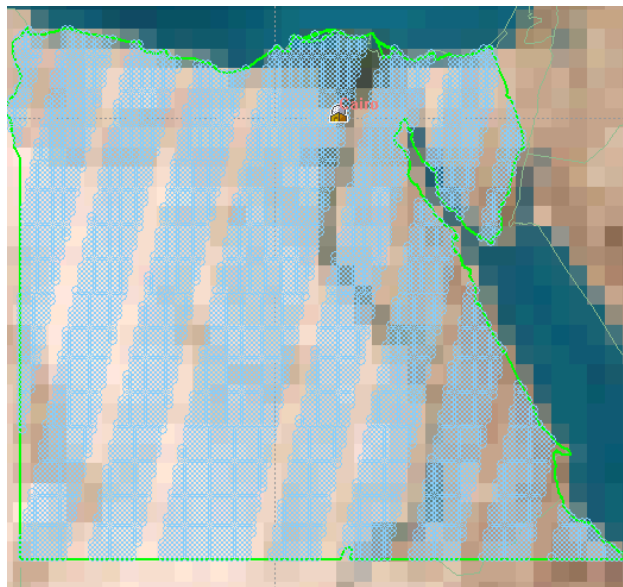
Egycubesat-1 Project



A 660-km orbital altitude coverage for the period from 1 Jan
to 10 Jan 2011 (29.62%)



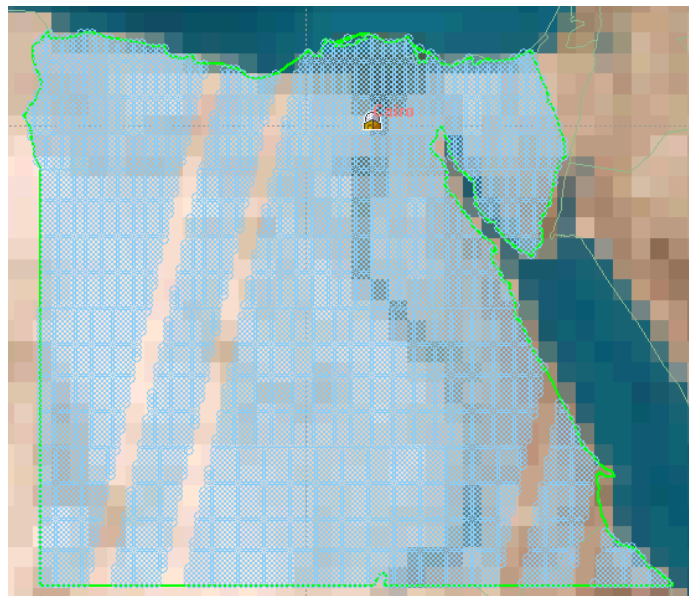
Egycubesat-1 Project



A 660-km orbital altitude coverage for the period from 1 Jan to 20 Jan 2011 (71.94%)



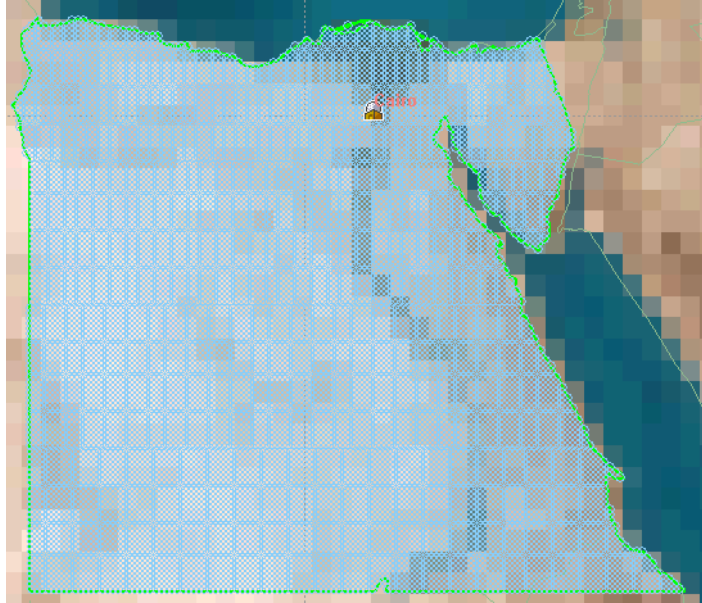
Egycubesat-1 Project



A 660-km orbital altitude coverage for the period from 1 Jan to 30 Jan 2011 (88.9%)



Egycubesat-1 Project



A 660-km orbital altitude coverage for the period from 1 Jan to 5 Feb 2011 (100 %)



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Conclusion

- Egycubsat-1 is a project that is being implemented at NARSS, supported by the EU, and is expected to be launched 2011.
- Egycubsat-1 has international partners (SSTL, VEGA, ITU,...).
- Egycubsat-1 is in the process of negotiating launch services with MHI.
- Egycubsat-1 has strong relationships with Egyptian universities.
- Egycubsat-1 is seeking international alliances with Japanese Institutions and JAXA.