

A nano-satellite constellation for tracking and monitoring endangered wildlife in developing countries

Introduction

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Implementation
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Conclusion



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Introduction

- Existing systems



- Developing countries struggle to afford equipment, manpower, services for conservation activities

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Mission Objectives

- Provide an affordable solution for developing countries
- Constellation of microsatellites to assist with data retrieval from field devices
- Provide global coverage with emphasis on Africa, South America, South East Asia
- Automate existing ground stations to reduce costs

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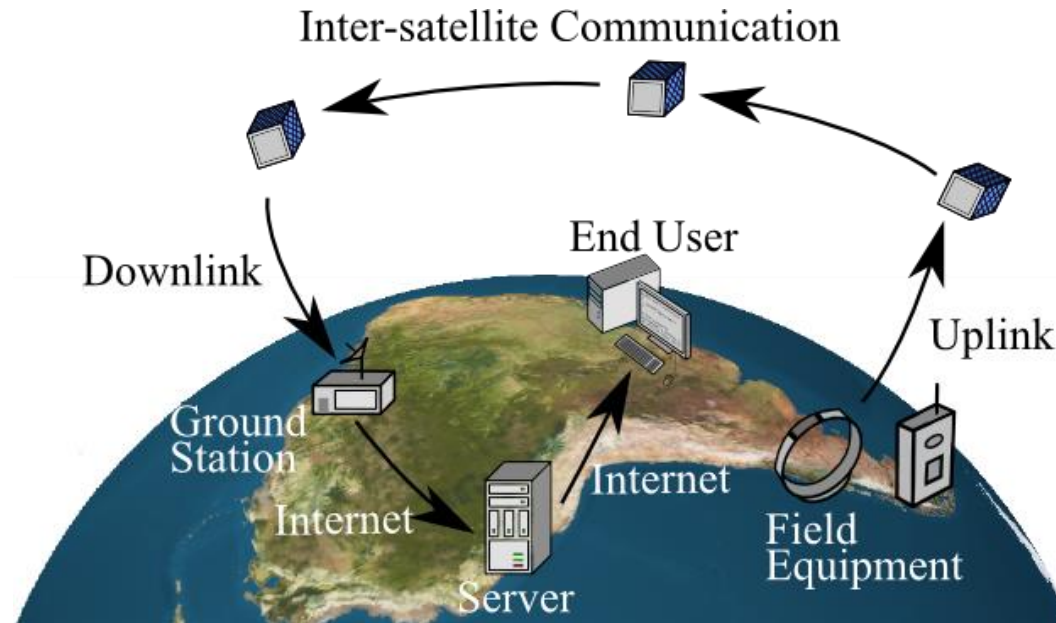
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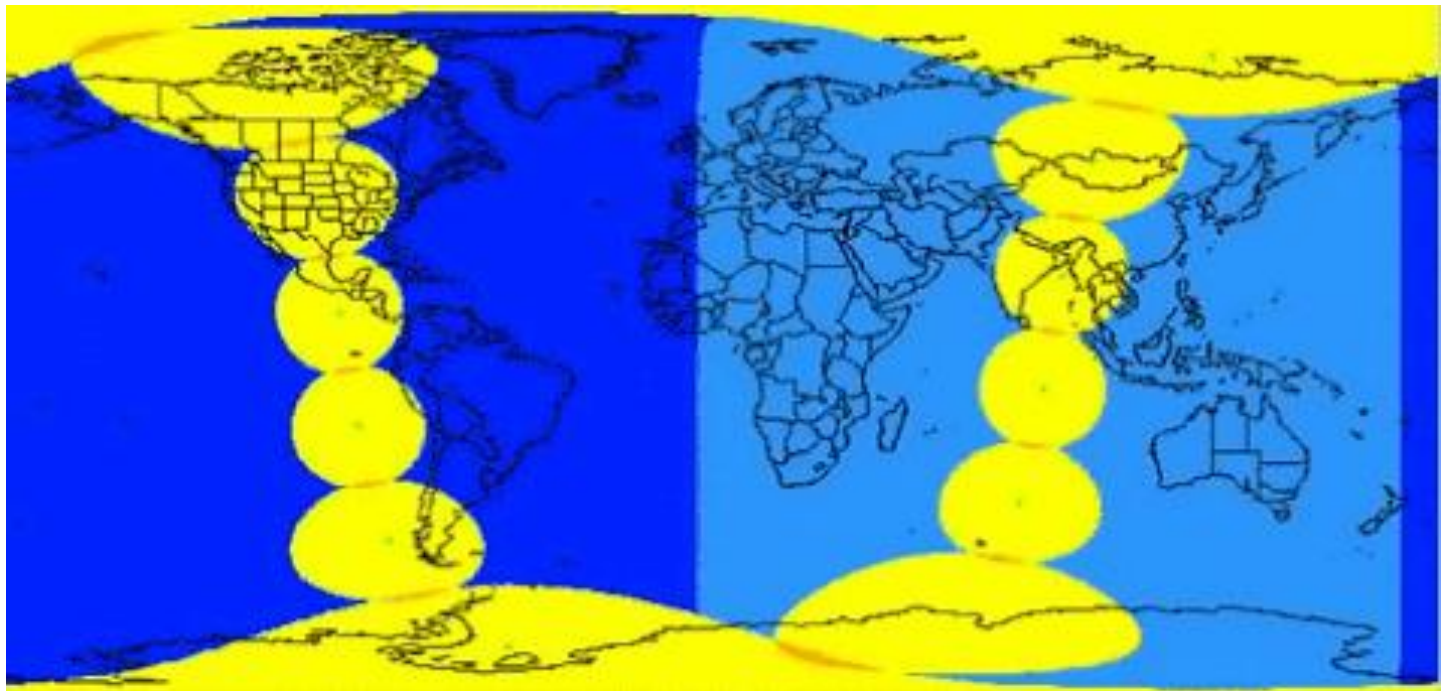
Mission Concept



Constellation acts as a communications relay between field devices and end-users

Mission Concept (Space)

12 Satellites in a pearl string constellation



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Mission Concept (User)

- Encompasses all devices used for conservation
- Devices require satellite communication capabilities
- User access to new data twice daily
- Ultimate goal to provide the service for free using crowd funding and donations

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Satellite Design - Communication

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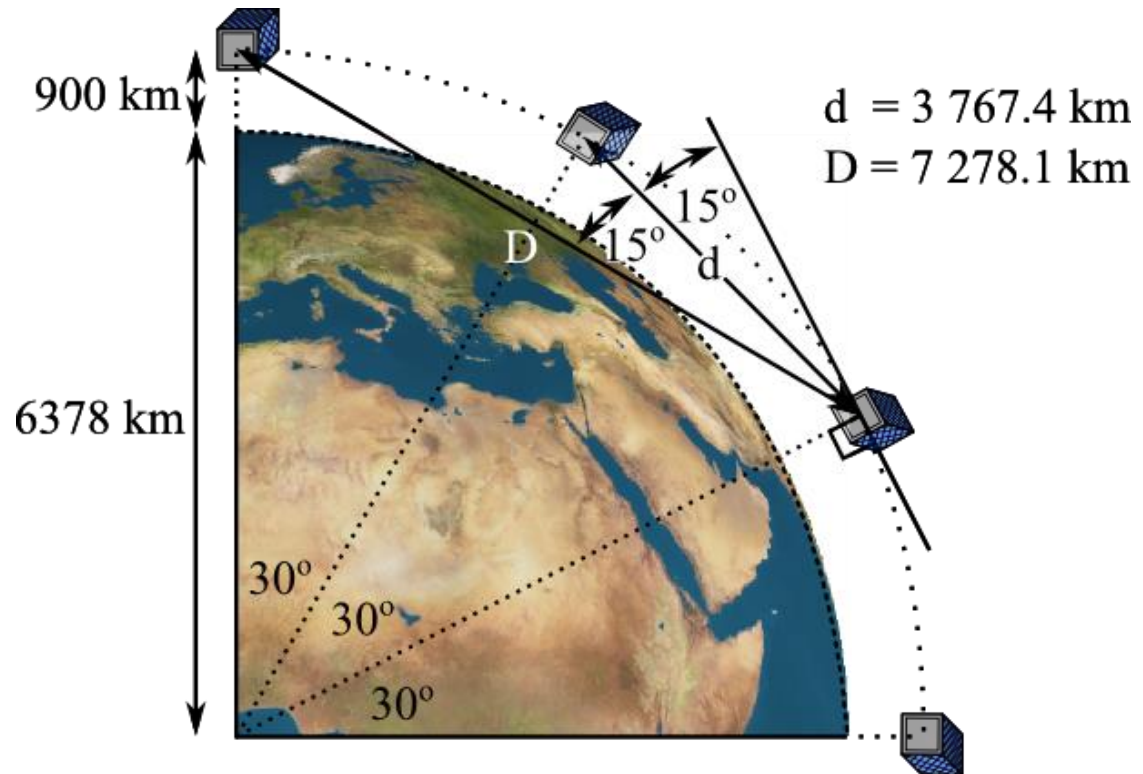
Conclusion

- Patch antenna on +Z facet for ground station communication
- Antenna swath width of 3500 km
- Dipole antennas used for link between satellite and field equipment
- Provide access times of 105 minutes every 12 hours with revisit time of 10.25 hours
- Service up to 519 devices in an area (828 kB throughput)



Satellite Design – Communication

- Patch antennas on -X and +X facets for ISL



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Satellite Design - ADCS

- Sensors - earth sensor, sun sensors, 3-axis magnetometer
- Actuators - Magnetic torquers, Y-axis momentum wheel, propulsion system
- ADCS modes - detumbling, orbit phasing, nominal, orbit maintenance, deorbiting

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Satellite Design

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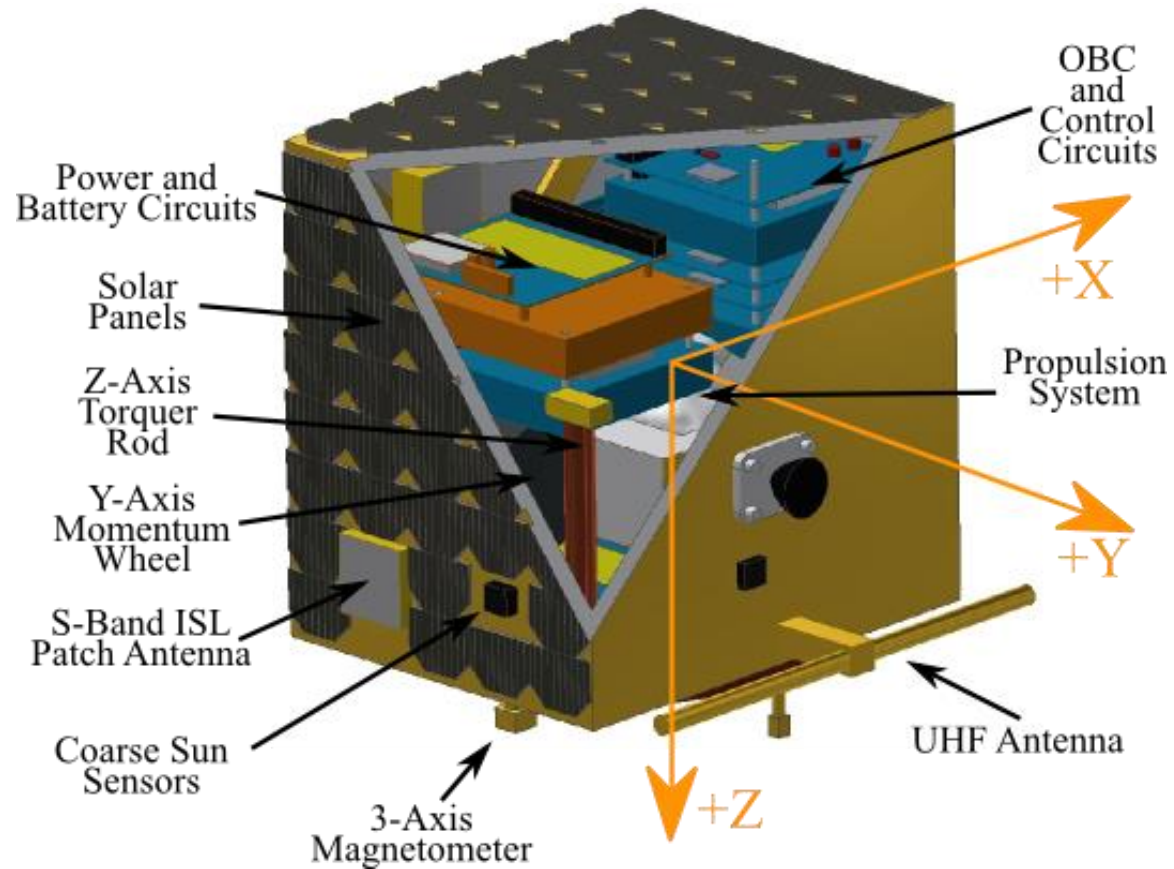
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Satellite Design - ADCS

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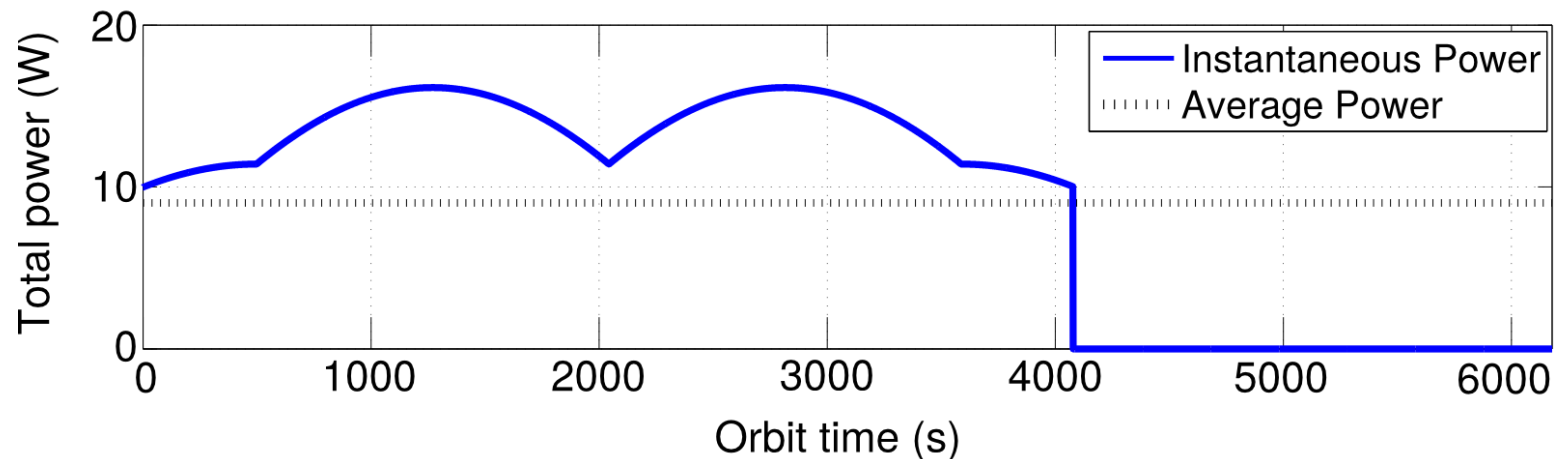
- Orbit phasing
 - 30° phase between adjacent satellites
 - Worst case = 180° phase, 60 days, 48 g propellant
- Orbit maintenance
 - 12 manoeuvres over 10 years
 - 10 g propellant
- Deorbiting
 - Deorbit constellation within 25 years
 - Drag enhancing device
 - 713 g propellant



Satellite Design - Power

- +X, -X and -Z facet solar panels
- 0.25 x 0.2 m per facet
- 5.9 W required average
- 9 W average generated by solar panels

Worst-case EOL power generation by solar panels



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Satellite Design – Thermal, Mass, Volume

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- Passive thermal control maintains acceptable operating temperatures
- Estimated satellite mass is 8.18 kg
- Preliminary satellite dimensions 0.25 x 0.2 x 0.25 m
- Estimated volume usage of 62%



Satellite Design – Radiation

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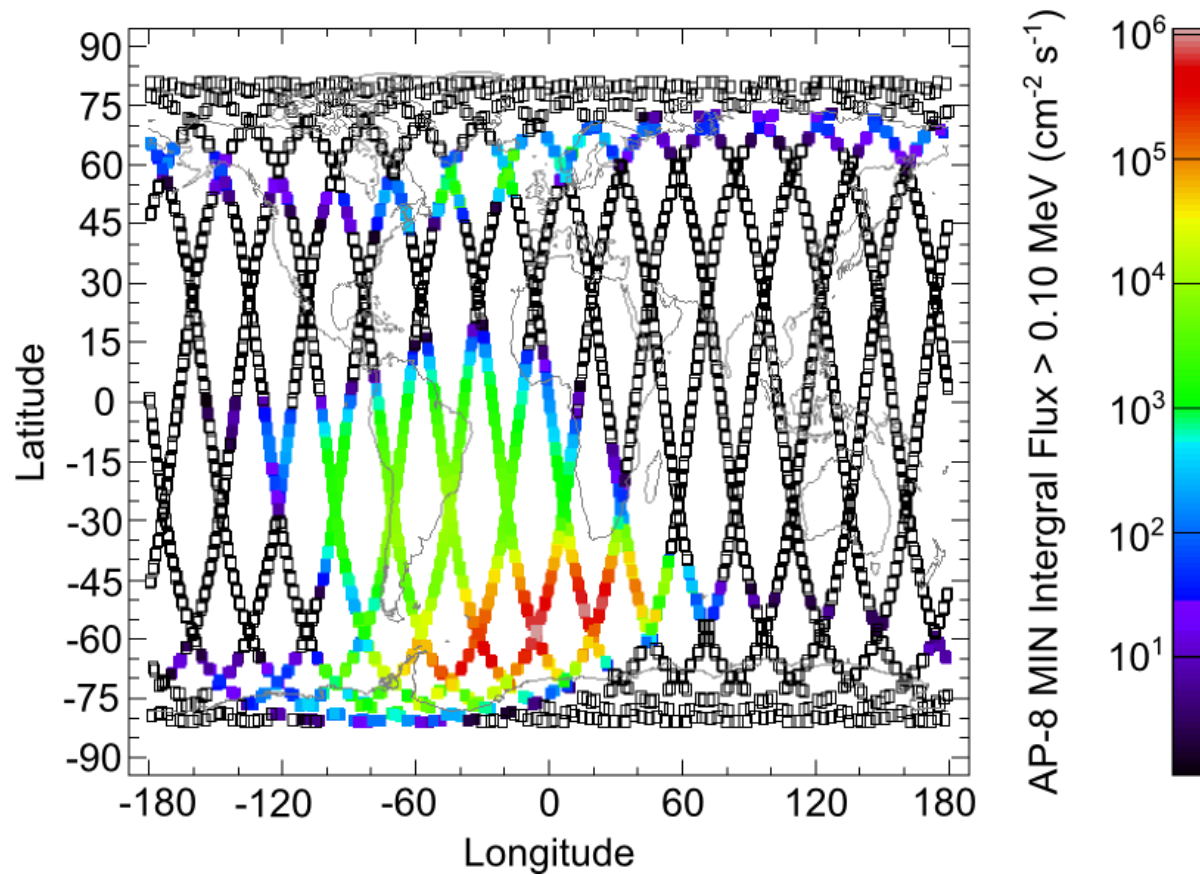
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Implementation Plan

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- 18 month development time
- Phase development and launch plan
- Total cost of € 3.44M for development and 10 year operation
- Funding options include crowd funding and donations
- Funding options assist possibility of providing a free service

Past crowd funded space missions have been successful ¹.

[1: www.kickstarter.com/projects/arkydforeveryone/arkyd-a-space-telescope-for-everyone-0](http://www.kickstarter.com/projects/arkydforeveryone/arkyd-a-space-telescope-for-everyone-0)



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- Promote and improve conservation activities on a global scale
- Pave the way for future advancement in conservation

