‘Space Tech’ – an OVERVIEW

AEOLUS AERO TECH, Pvt. Ltd.

‘**Aeolus Aero Tech Pvt. Ltd.**’ (Aeolus) based in Bengaluru, Karnataka, India, provides a wide range of Products, Services and Technology Solutions in Alternative Energy, Automobile, Aeronautical, Space Tech, Defense and General Engineering OEMS. Aeolus offers a variety of equipments for laboratories to cater to R & D (educational & industry uses) and for academic institutions.

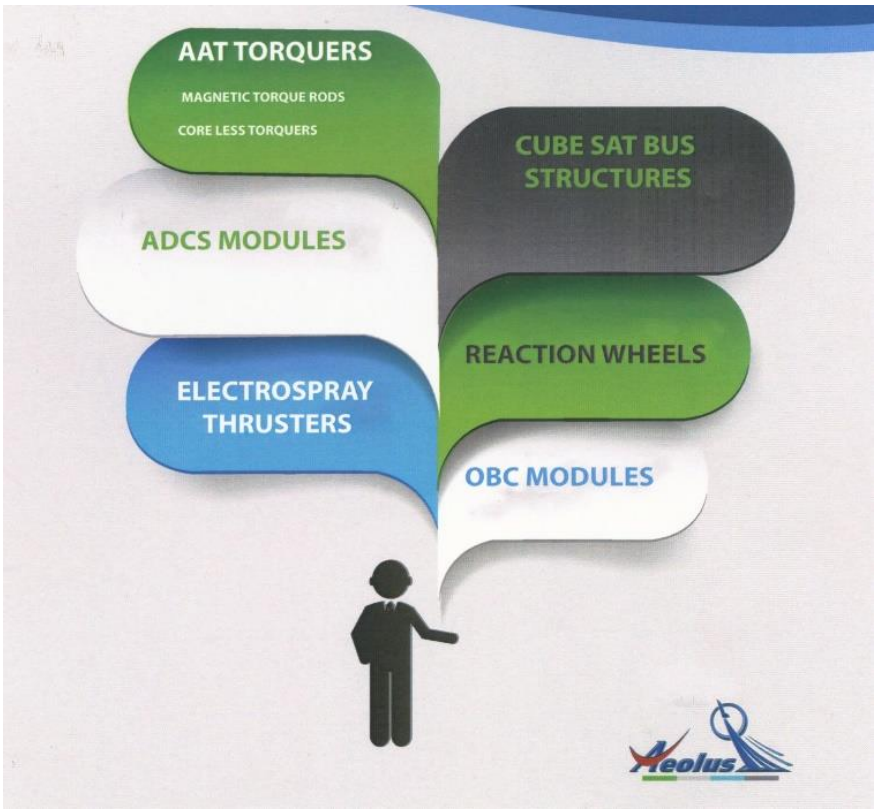
Aeolus is uniquely positioned to provide Micro-Gravity Research Opportunities **in collaboration with the ‘SPACE TANGO’ of Kentucky, USA,** for its clients in sectors such as Education, Bio-tech, Medical, Pharmaceutical, and other Industries, through the **TANGO Labs** in the **International Space Station**, based on selection criteria and availability,. Aeolus provides needed assistance in analysis after the project is returned to earth.

- ✓ Global Leader in Aerospace Products and Services
- ✓ Delivers affordable, high Technology Solutions
- ✓ Uncompromising Business Ethics & Delivery
- ✓ World class Technical Expertise & Collaboration
- ✓ Dedicated to Customer Satisfaction & Mission
- ✓ Assist with Manufacturing, Assembly and Testing
- ✓ Provide Life-time Engineering & Technical Support
- ✓ Champion Alternative, Green Energy Solutions

Aeolus Products & Services Domains

1. Educational Labs
2. Heat Pipes & Thermosyphons
3. Wind Tunnels
4. Space Science Products
5. Micro-Gravity Research
6. CubeSat: Design, Develop & Deploy
7. Wind Energy Technologies (500 W to 5 KW)

Space Exploration is exciting, challenging and risky. Yet, it positively impacts humanity with sophisticated products and services in a huge range of disciplines. Research is critical for space travel to sustain life in a hostile and barren environment devoid of water, oxygen, food, gravity, etc. Discovering ways to reuse, recycle, reduce waste and eliminate pollution in International Space Station, Moon, Mars, outer space, etc. help protect, preserve, conserve, reuse, recycle and replenish not only in space, but also use these methods on earth as well.



Space Products from ATT

a) AAT Electro-magnetic Torquers:

- ✓ Control the attitude of cube satellites around three axis.
- ✓ Optimally designed, with very low mass and compatibility.
- ✓ Well balanced electrical and mechanical parameters
- ✓ Ensure required magnetic field at minimal power consumption

b) AAT CubeSat Bus:

- ✓ Designed and developed per CubeSat Standard
- ✓ High degree of Payload adaptability
- ✓ Custom designed to maximize the payload
- ✓ Designed for efficient deployment of subsystems

c) ADCS (Attitude Determination and Control) Modules:

- ✓ ADCS Software designed for small satellites
- ✓ Has Sun Sensors, Magnetometer & Gyros
- ✓ Has Reaction Wheels (based on mission)
- ✓ Has Electromagnetic Torque Rods
- ✓ Algorithms and functions to assist attitude
- ✓ Suitably control the Attitude of small satellites
- ✓ Adaptable to many platforms & subsystems
- ✓ 3 Axis pointing ideal for Earth imaging

d) ATT Reaction wheels:

- ✓ Miniature Reaction wheels for fine pointing
- ✓ Accurate control of Cubesat attitude
- ✓ Handles: Sun pointing, Payload pointing, Thruster pointing, and Ground station tracking
- ✓ Suitable for Earth Imaging, Communication and missions requiring high accuracy

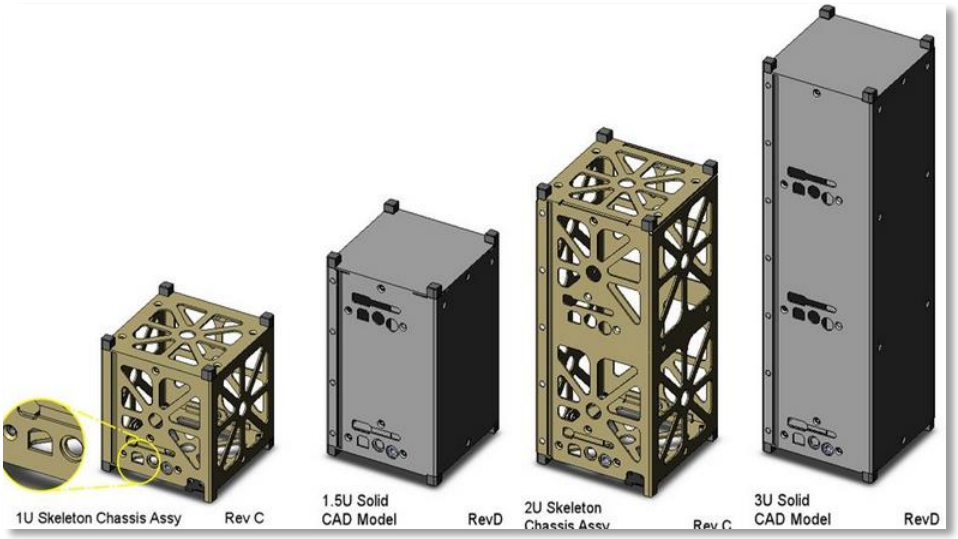
e) OBC Modules:

- ✓ High Performance Processing Unit
- ✓ Based on MSP430 Processor
- ✓ Ideal for space environment
- ✓ Low power consumption
- ✓ Real time processing & very capable
- ✓ Easy to integrate with other subsystems
- ✓ Many interface options (Camera, Sensor, actuator, etc.)

f) AAT Thrusters:

- ✓ Multipurpose Electrospray Thruster
- ✓ Back up for ADCS or CubeSat De-Orbiter
- ✓ Minimum power consumption with high specific impulse
- ✓ Eco-friendly, Non-toxic

CUBESAT – Growing Demand:

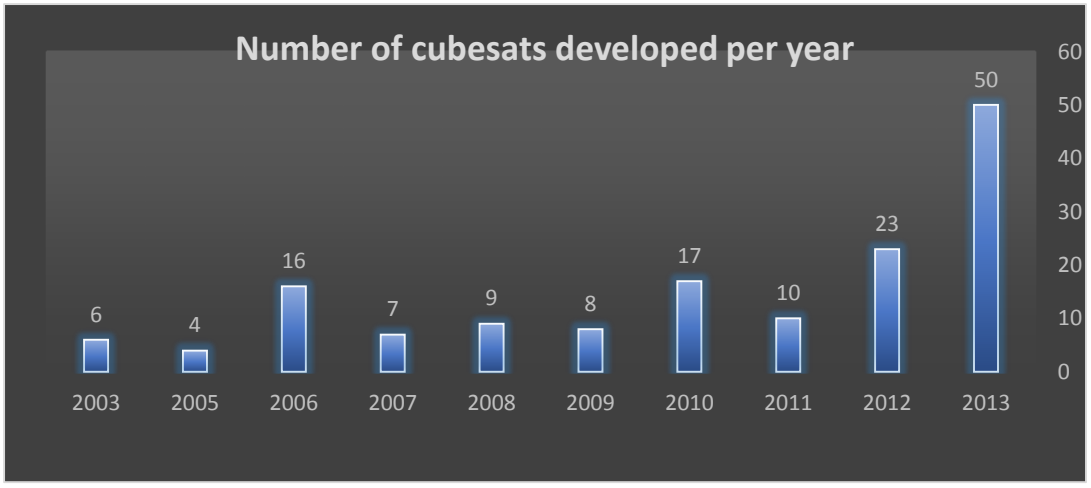


Nano / Microsatellite CAGR (Compound Annual Growth Rate)
2009 to 2013 37.2 % / year 2014 to 2020 23.8 % / year

Projected potential growth in CubeSat (Ref: SpaceWorks Enterprises, Inc. 2014)

Year	Est.	Year	Est.	Year	Est.
2014	130	2015	220	2016	380
2017	430	2018	490	2019	520

Growing demand for CubeSat (2003 to 2013)



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EDUCATION Sector: Many Universities and High schools are keen to explore the emerging space technologies. CubeSat costs are quite low and affordable meeting their general & specific mission objectives. We offer the following products and services to the education sector:

Hardware: Structure – 1U, 2U & 3U
ADCS – Actuators/sensors.
ADCS - ADCS OBC
COM – UHF/VHF Transceiver, Antenna Module
C&DH – C&DH OBC
Ground station – Antenna setup, transceiver, TNC

Software: ADCS – Attitude Determination
Attitude Control Algorithms
C&DH OBC Software
COM SDR Software

Services: Mission development cycle
Mission requirement preparation
Subsystem need identification
Subsystem development for mission
Integration and testing – unit testing (Subsystem only), system testing (Spacecraft)

Student Learning in the lab:

- CubeSat lab kit to study general characteristics and operations
- Improve understanding of 'mission development'
- Lower mission cost by reducing potential problems / damage to components
- CubeSat simulator - a fully assembled functional model to experiment in the lab.

INDUSTRY Sector: Industrial Clients handle compliance matters with their own country regulations and international Space Use norms. As required, we offer customized industrial applications

(i) Durable components
(ii) Longer shelf-life,
(iii) Fully functional and
(iv) Reliable over its lifetime.

CubeSat: (i) CubeSat designing
(ii) CubeSat subsystems and components – based on specific needs.
(iii) Complying with International Space Communities norms
(iv) Reducing / eliminating space debris as an integral part of the original design

Satellite Subsystems:

1. Satellite Structures – 1U, 2U, 3U
2. Command and Data Handling System
3. Communication System
4. Attitude determination and control system
5. Electrical Power System
6. De-Orbiter Devise / Propulsion System

Components:

1. Reaction Wheel
2. Magnetic Torque Rod
3. Deployable Solar Panels
4. Sensors

5. Ground Station Equipments

Services:

1. Mission Analysis
2. Product development support
3. Verification and validation
4. Integration and Testing
5. Manufacturing
6. Advanced Engineering Services (CAE/CFD/CAD)
7. Related software development

3 U CubeSat	CUBE-SAT Common Applications:
	1. Earth Observation & Mapping 2. Disaster / Agri / Forest Survey 3. Education & Skills Development 4. Weather forecasting 5. Tele-Communication / Outernet 6. Biotech / Scientific Research 7. Earth Remote Sensing 8. Military Use / Border Security 9. Asteroid Exploration 10. Space Technology Demo 11. Astronomy / Interplanetory 12. Ship Tracking & Navigation

SUB-SYSTEMS- Estimated Pricing: (Subject to change based on specific requirements)

- ✓ Competitive, affordable & tailored to the Client's specific needs, giving the best ROI.
- ✓ Freight and Import Duty, VAT, Sales Tax, etc. (where applicable) - added as applicable.

Indicative base prices (subject to modification based on specific needs):

➢ CubeSat Frames	1 U	10 x 10 x 10 cm	– USD 1,980
	2 U	10 x 10 x 20 cm	– USD 2,800
	3 U	10 x 10 x 30 cm	– USD 3,200
➢ Command and Data Handling System			– USD 20,500
➢ Communication System Transceiver			– USD 8,500
➢ Deployable Antenna Module			– USD 3,000
➢ Attitude determination and control system Module			– USD 16,500
➢ Electrical Power System			– USD 3,600
➢ Reaction Wheel (1 No)			– USD 3,000
➢ Magnetic Torque Rod (1 No)			– USD 1,500
➢ Coreless MTR (Magnetic Torque Rod) (1 No)			– USD 1,200

Essential Items to include in the Project budget:

Customer is responsible for and shall take care of the following (including, but not limited to):

(i) Freight + Shipping Insurance,
(ii) Import Duty,
(iii) Customs Clearance,

(iv) Vat / Sales Tax,
(v) CubeSat approvals, launch cost, etc.
(vi) Project + Satellite Insurance

Space Tech Customers:	**Major Domains**
✓ Colleges and schools	(Education and training)
✓ Oil and gas industry	(Earth monitoring)
✓ Government	(Education, earth imaging, remote sensing)
✓ Non –government org (NGO)	(Remote sensing)
✓ Biological research industry	(Microgravity)
✓ Cube sat system developer	(Technology demonstration)
✓ Space agency	(Thermal control system demo)
✓ Communication industry	(Range and efficiency)
✓ Remote sensing industry	(Geology, environment and climate change)
✓ Military application	(Border security; Battle / Terrorism management)

Import Formalities: All sales are subject to Client obtaining required approvals and clearances by the respected authorities in their home country and release by the country of origin. Securing required approval / permit / import license / customs clearance, etc. and any related costs are the client's responsibility. Aeolus shall provide the standard shipping documents to facilitate these and offer customized solutions to suit the individual Client's exacting needs.

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PS: '**Resources International, Inc.**' Lexington, KY, USA, established in 1994, is an international Marketing and Import-Export firm, part of a close-knit group of family-owned companies.