PocketQube: A New Opportunity and It's Challenges

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Group Discussion

Group 5

PocketQube: A New Opportunity and It's Challenges

Group of Astrodynamics for the Use of Space Systems

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Assistant: TBD

PocketQube is a pico-satellite of size 5 cm cubed, and weighs 180 grams. The standard was proposed by Prof. Bob Twiggs, who also introduced CubeSat standard. For a developing country the cost of CubeSat projects is still very expensive, which can cost at least 100k US dollars. The building cost of PocketQube could be as cheap as 5k US dollars, and the launch cost is around 25k US dollars. In addition, the development time is short, therefore, undergraduate and graduate students can learn the complete cycle of the satellite development, launch, and work on post processing of the downlink data.

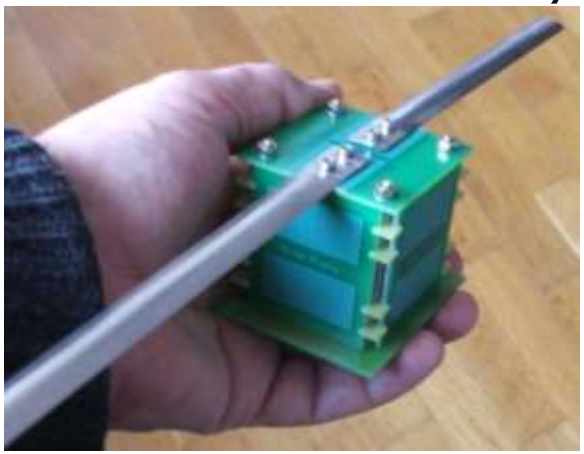
The PocketQube can be used for teaching about small-satellite technology at university level. It can also be used by educational and research institutes, as a platform for capacity building, technology demonstration, and technical development of space research at a very low cost.

Discussion Contents:

1. Advantage of moving from CubeSat to PocketQube for small company and educational institute, and developing country
2. Investigation of possible Payload for PocketQube
3. Identifying potential launch providers
4. Possible collaboration among the participants' institute and company in the discussion group
5. Debris risk of PocketQube

History of PocketQube (PQ)

- 2009: PQ Specification, by Bob Twiggs
  - **5cm X 5cm X 5cm, 180 grams (1 unit: 1P)**



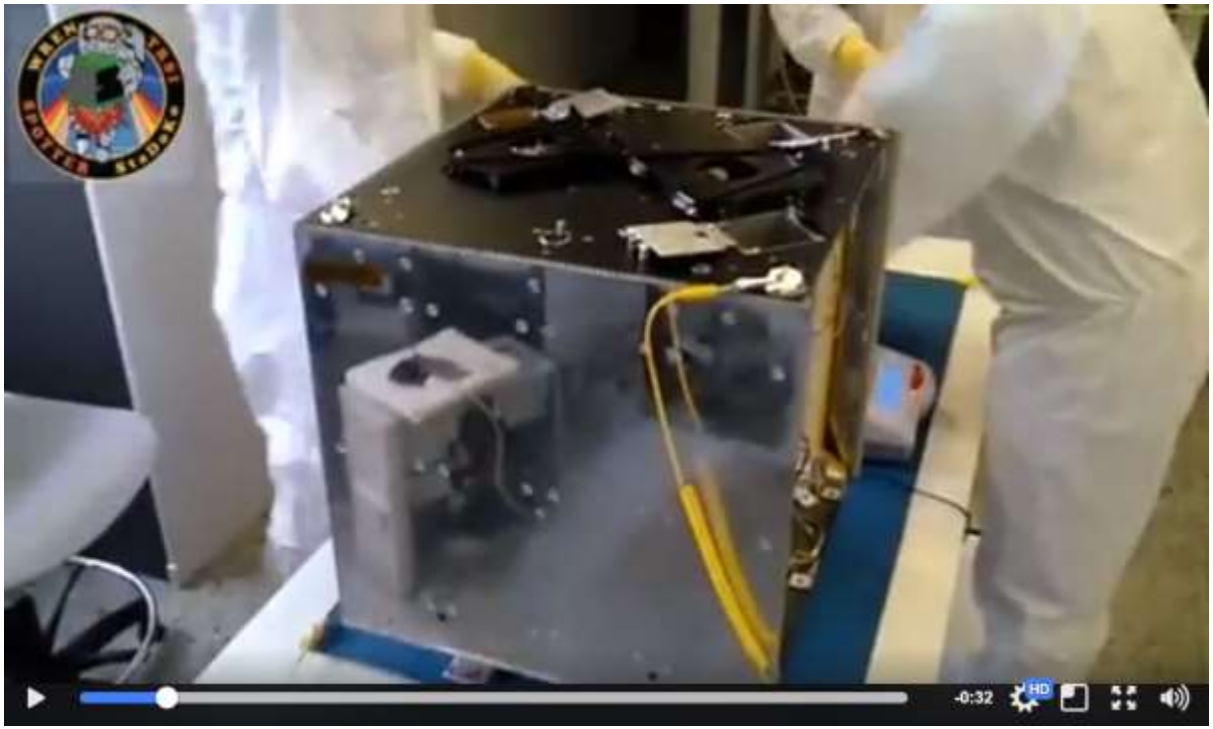
Can easily fit on your palm or in your pocket!

SMOG-1 during development phase
http://www.gnd.bme.hu/smog1/pictures/articles/zsebi_big.jpg

- 2013: 1st launched by GAUSS on ‘UniSat-5’
- Eagle-2 (50$-Sat) made history!

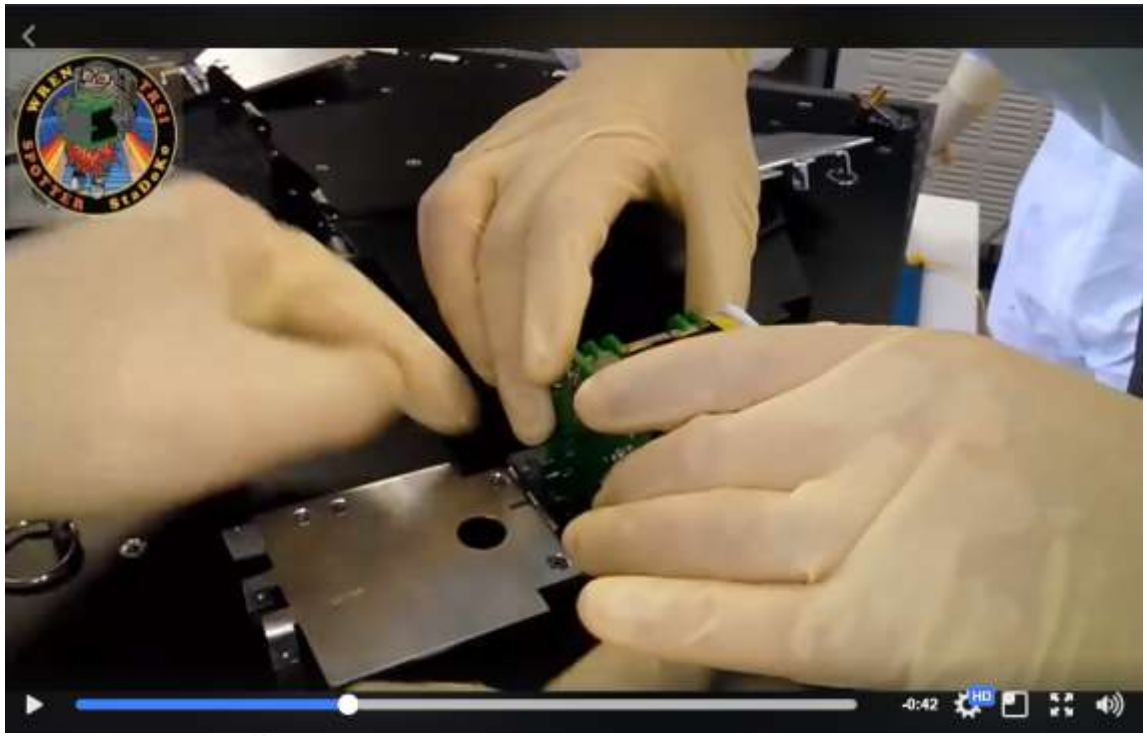
- *Eagle1* (USA)
- *Eagle2* (USA)
- *WREN* (Germany)
- *QBScout* (USA)

The Mothership: UniSat-5 (video)



https://www.facebook.com/ORIONSpaceNepal/videos/711532185720862/

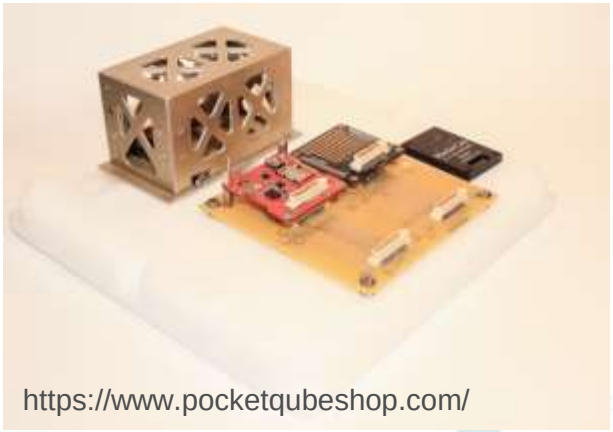
Integration of WREN in UniSat-5 (video)



https://www.facebook.com/ORIONSpaceNepal/videos/711535199053894/

PocketQube Kits

- AlbaOrbital, Glasgow, Scotland
- PicoSat Systems, Australia
- Satellite Applications Catapult, UK



https://www.pocketqubeshop.com/

https://www.facebook.com/ORIONSpaceNepal/

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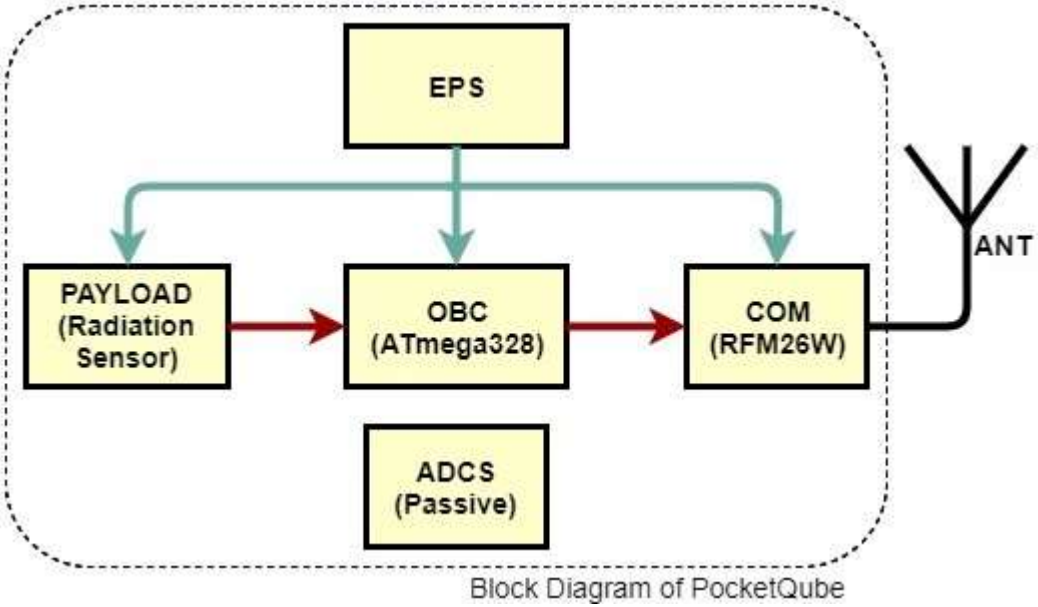
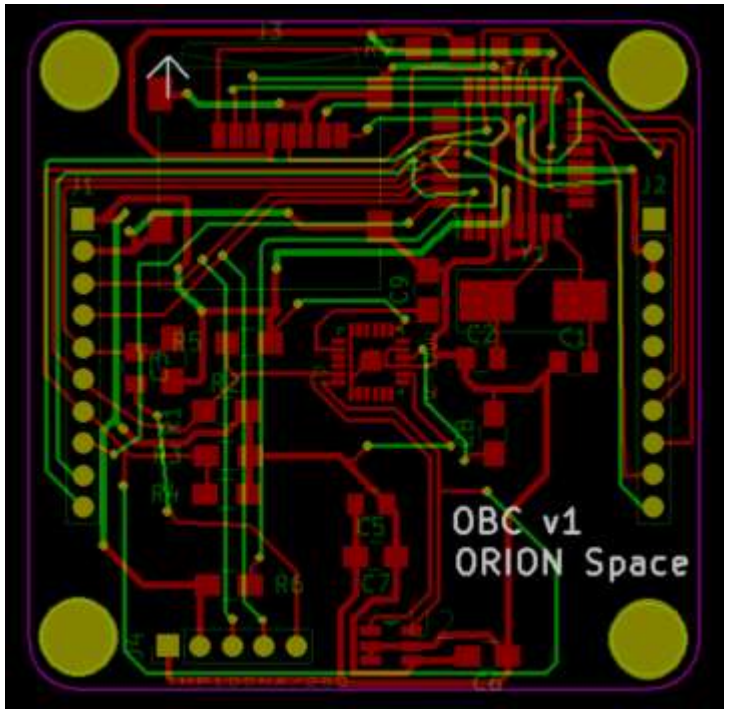
PQ Project at ORION Space

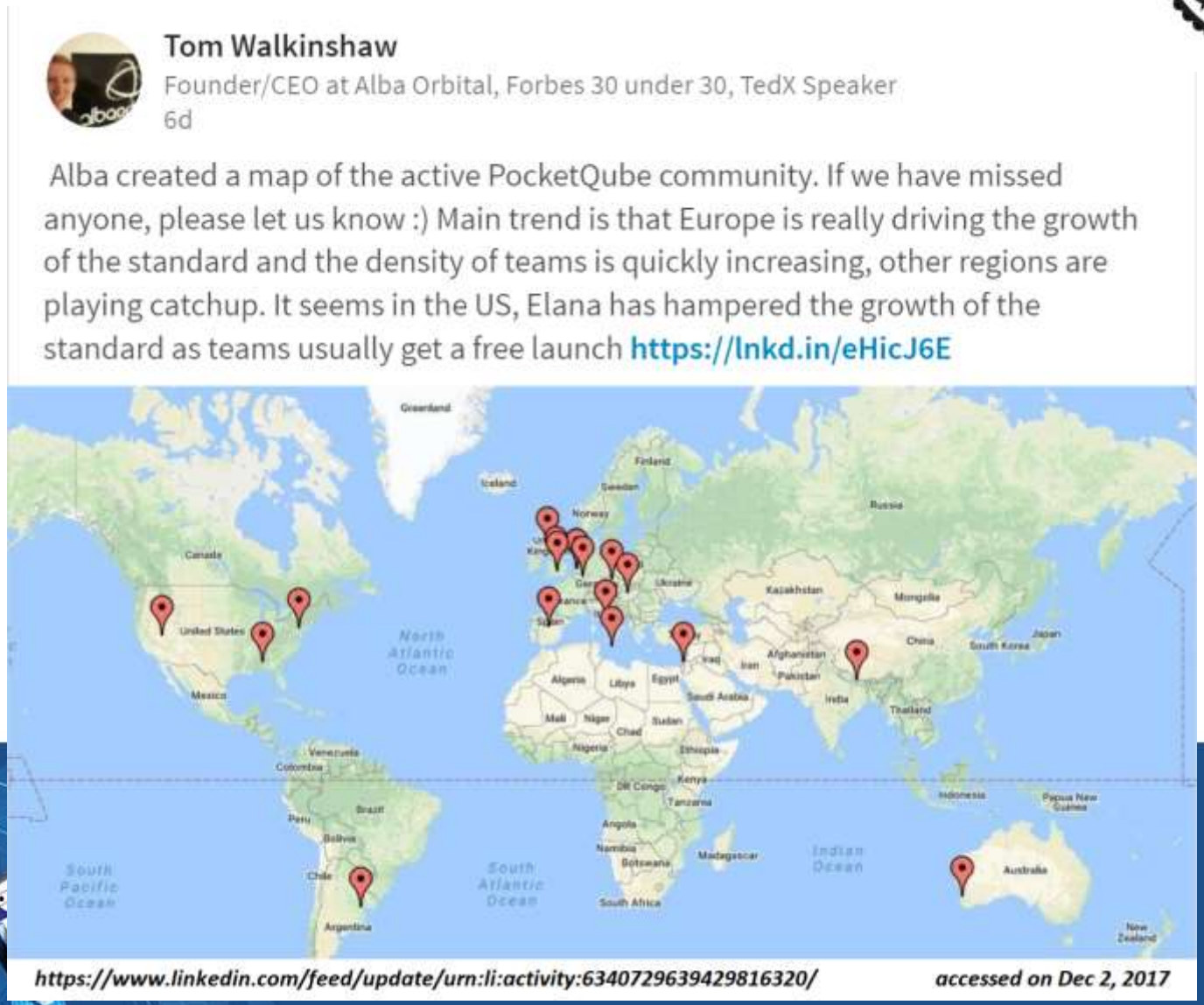


Block Diagram of PocketQube



OBC Board V1.0

Activities Related to PQ



Some of the PQ Projects

- PQ in development, waiting for launch
  - **Unicorn-1 (launch 2018)**
  - **OzQube**
  - **SMOG-1 (launch 2018)**
  - **ADS-B Sat**
  - **Nepal-PQ1**
  - **UoMBSat**
  - **Delfi-PQ**
  - **ArduOrbiter-1**
  - **DIY-Sat (launch 2018)**
  - **Unicorn-2**

(discuss at the end in details)

Payload Ideas for your PQ

- QubeScout S1: *Fine Sun Sensor*
- T-LogoQube: *CZT Array*
- WREN: *Camera, 3 Axis Reaction Wheel, Pulsed Plasma Thrusters*
- OzQube-1: *Camera*
- SMOG-1: *Spectrum Analyzer*
- *Inter-satellite communications*
- *De-orbit technology (active/passive)*

https://www.pocketqubeshop.com/9-payload-ideas-for-your-pocketqube-satellite/

(discuss at the end in details)

CubeSat vs PocketQube

- + cheaper (5k build, 25k launch euro)
- + short development period (6 months, 1 year)
- - less volume
- - less power
- + simple structure
- + educational purpose
- space debris (?)

Table 1: Length scaling of key parameters

	CubeSat	PocketQube
Side	L	$\frac{1}{2}L$
Area	L^2	$\frac{1}{4}L^2$
Volume	L^3	$\frac{1}{8}L^3$
Mass	DL^3	$\frac{D}{8}L^3$
Solar power	ηL^2	$\frac{\eta}{4}L^2$
Inertia	$\frac{DL^5}{6}$	$\frac{DL^5}{64}$
Magnetic moment	$\frac{6k}{DL^3}$	$\frac{2}{3}\frac{k}{DL^3}$

https://www.researchgate.net/publication/308777632_CubeSats_to_PocketQubes_Opportunities_and_Challenges

(discuss at the end in details)

Collaboration & Launch Provider

- ***Possible Collaboration*** between
  - **PQ working team (work on different subsystems)**
  - **UNISEC Global**
  - **GAUSS**
- Integrate sub-systems, and **share launch cost**
- Other possible launch providers
  - **GAUSS**
  - **NanoRack (?)**
  - **PLSV (?)**

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THANK YOU