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Roma, Italy
Starting from the experience and the enthusiasm grown at the School of Aerospace Engineering, some professors, researchers and students decided to continue the tradition of the school founding the limited liable company G.A.U.S.S. Srl, evolving from a didactical dimension to an innovative company reality.

The company business is mainly related to the design and manufacturing of space systems which are also intended as release platforms for CubeSat and PocketQube using the deployers PEPPOD and MRFOD, thus letting begin G.A.U.S.S. to be a launch provider for small satellites.
In the last years, the interest of University, Private Companies and government agencies in launching micro-satellites is growing up. CubeSats or smaller femto-satellite PocketQube.

A few years ago this class of satellites were considered only for didactical or for in-orbit test purposes. Recently they are even more used in constellations made with high performance technologies.
The complexity of the missions for these satellites, is quickly growing up. There is the need to offer fast, multiple and alternative solutions to satisfy the customers’ goals.

G.A.U.S.S. Srl has innovated the idea of launch provider developing civil and scientific satellites having two primary purposes:

- acting as Launch Platforms to carry and deploy in the Space other smaller satellites;
- hosting payloads on board for scientific missions, testing equipment in space condition, providing power, intelligent control and telecommunication services for the hosted payloads.
UniSat Satellites as Launcher Platforms:

- **Some actual advantages:**
  - Payloads of the satellites UniSat, are not more tied directly to the scheduled mission of the rocket.
  - It is possible to avoid the dangerous clouds of satellites at the separation time.
  - More satellites of a constellation can be launched on the same cluster launch, but released at different times.

- **Future goals for G.A.U.S.S.:**
  Make their platform satellites able to change orbits (orbital and attitude control) and release the payloads in a known attitude control status.
In less than two years UniSat-5 and UniSat-6 have carried in to space 12 small satellites:

- **2013 - UniSat-5** has released 7 satellites using 2 PEPPOD and 3 MRFOD deployers. It has been the first Spacecraft that has carried in to space the new standard of femto-satellites, the PocketQube.
- **2014 - UniSat-6** has released 4 CubeSats using 2 PPOD deployers from CalPoly and 1 PEPPOD. One of the Cubesats has also split in 2 half units.
Since the year 2000, G.A.U.S.S. has launched satellites with the support of the International Space Company (ISC) Kosmotras. Taking advantages of this fruitful cooperation, G.A.U.S.S. Srl is actually able to offer launch services for microsatellites in general.

Reliability: currently, the mission reliability factor for the rocket is 0.97
UniSat-6 Mission:
It was launched in June 19th 2014 from Dombarovsky Cosmodrome at Yasny (Russia).

Cluster Mission of 32 satellites (37 considering the UniSat-6’s payloads).
# UniSat-6 Mission:

<table>
<thead>
<tr>
<th>Name</th>
<th>Class</th>
<th>Mission Purpose</th>
<th>Ownership</th>
<th>Country</th>
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<tr>
<td>UniSat-6</td>
<td>NanoSatellite</td>
<td>Educational Deployer of Cubesat using PPOD and Peppod</td>
<td>GAUSS Srl</td>
<td>Italy</td>
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<td><strong>No military purpose</strong></td>
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<td>TigriSat</td>
<td>3U CubeSat</td>
<td>Deployed from UniSat-6 University student education</td>
<td>University of Rome, Sapienza</td>
<td>Italy</td>
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<td></td>
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<td><strong>No military purpose</strong></td>
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<tr>
<td>AeroCube6</td>
<td>1U CubeSat</td>
<td>Deployed from UniSat-6 Reserch and Development</td>
<td>CalPoly</td>
<td>USA</td>
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<td>2U CubeSat</td>
<td>Deployed from UniSat-6 Educational</td>
<td>Universidad de la Republica (UdelaR)</td>
<td>Uruguay</td>
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<tr>
<td>Lemur-1</td>
<td>3U CubeSat</td>
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UniSat-6: Deployment System

Orbital Deployers:
- 1x PEPPOD (G.A.U.S.S. Srl)
- 2x PPOD (CalPoly)
UniSat-6: PEPPOD Deployer

- It is **lighter** than other Orbital Deployers, it is well suitable to be installed on Spacecrafts.

- It was designed by G.A.U.S.S. Srl to be used with 1U, 2U and 3U CubeSats, it is also **customizable on request**.

- It uses the high reliable and space qualified **FRANGIBOLT** opening system (TiNi-Aerospace).

- It was **used with success** on UniSat-5.
UniSat-6: Deployment Strategy

- **Primary automatic release system:**
  - completely autonomous
  - redundant activations
  - hardwired logic (no microcontrollers)
  - dedicated battery pack

- **Release Time of CubeSats:** 25h 38’ after the separation of UniSat-6 from the Dnepr LV, following a precise scheduling

- **Secondary redundant release system:** by TT&C it is possible to override the automatic system to open the PODs
UniSat-6: the satellite

- **Orbital parameters:**
  - quasi sun synchronous orbit
  - Around 700km height
  - period of revolution 5878s
  - orbit inclination 97,98°

- **Shape:** A cube of 40cm side by side

- **Weigh:** 26 Kg with payloads inside

- **Attitude control:** passive with permanent magnet and histeresys rods
UniSat-6: Ground Segment & communications

- UniSat-6 is clearly received at very low elevation (about 1°) by ground stations.
- It is also possible to receive the telemetry by radio-amateur handsets without any modifications.
- A Dedicated software has been developed by G.A.U.S.S. Srl for uplink and downlink operations.
- Since the first day in orbit, up to 5 passes per day have been followed over Rome, downloading stored telemetry and pictures.
UniSat-6: Sub Systems

5 Solar Panels

EPS/BCR System

On Board Computer ABACUS

UHF Radio & RHCP antenna phasing

System battery

On Board Camera

Indipendent Automatic release system

Release battery

Antennas

POD_1

POD_2

POD_3

Redundant control

G.A.U.S.S. Micro Satellites: Experiences and Proposals
UniSat-6: Sub Systems


ABACUS On Board Computer (G.A.U.S.S. Srl and “Sapienza” University of Rome)
UniSat-6: Sub Systems

Bottom Solar Panel
Power 5W
(G.A.U.S.S. Srl)

On Board Camera
3 Mpx Jpeg
(LinkSprite)
UniSat-6: the Point of View from the Space

 poblak pictures in low resolution (for video) in a pass over Italy
Mid resolution pictures: clouds on Madagascar, Tunisia and Earth view
UniSat-6: the Point of View from the Space

- Mid resolution pictures: Caspian Sea, Iraq and Persian Gulf

Tigris River
Euphrates River
UniSat-6: the Point of View from the Space

- Mid resolution pictures: clouds on Brazil
UniSat-6: Integration time

In the pictures: P. Teofilatto - V. Kainov - F. Graziani - M. Truglio - C. Massimiani - S. Paiano - A. Conde Rodriguez
Towards UniSat-7..... from the past to the future
Towards UniSat-7: On-Going Projects

- **Structure:**
  - G-POD
  - Q-POD
  - PentaPOD

- **Attitude Control:**
  - Magnetic Torquers
  - Reaction Wheels

- **Electric Propulsion:**
  - Pulsed Plasma Thruster (PPT)
Proposals: the Point of View from the Earth

Picture of UNISAT-6 as seen over Bilbao (Spain)

credits Aitor Conde
Proposals: the Point of View from the Earth

- Space Debris Observations:
  From the Earth - the Castelgrande Observatory is an optical space debris observation center in Italy.

Castelgrande Observatory (Italy)
Proposals: the Point of View from the Space

- **Deorbiting Systems:**
  - *Sirdaria Sail*, a deployable sail with the purpose of increasing the aerodynamic drag reducing satellite mechanical lifetime.
  - **Propulsion**

- **Space Debris Observations:**
  - From the Space – the proposal is to use a telescope on board of a satellite

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G.A.U.S.S. Micro Satellites: Experiences and Proposals
Thanks to...