



OUR EXPERTISE FOR YOUR EXPERIMENT



ICECUBES
SPACE APPLICATIONS SERVICES





INTERNATIONAL COMMERCIAL EXPERIMENT SERVICE

Making access for space research
fast, simple and affordable

Our expertise for your experiment

ICECubes@spaceapplications.com

www.icecubesservice.com

[@ICECubesService](https://twitter.com/ICECubesService)



Silicon Valley Study in 2014

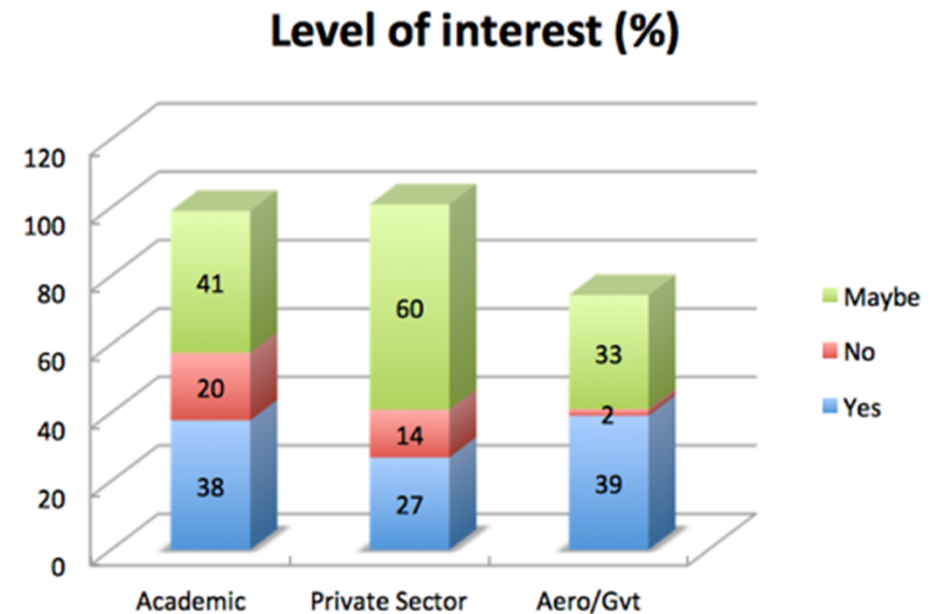
“Most high-tech academics and industry practitioners are not aware of the value of microgravity to their work or that the ISS is accessible to them”

**Microgravity-Based
Commercialization Opportunities
for Material Sciences and Life Sciences:**

A Silicon Valley Perspective



**The unawareness is large.
The interest is considerable.**



Microgravity – Benefits for Life Sciences

- > 3D cell aggregates
- > Accelerated cell growth
- > Increased virulence
- > Alterations in genes expression
- > Crystals grow larger and faster
- > Higher tissue fidelity
- > Organisms behave differently
- > Aging mechanisms

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Microgravity - Benefits for Physics

- > No solute buildup
- > No sedimentation
- > No convection
- > Defect free, homogeneous, perfect spherical shapes
- > Higher resolution
- > Containerless processing / Free suspensions

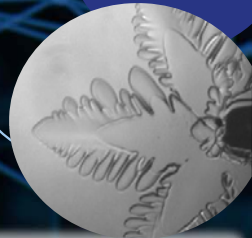
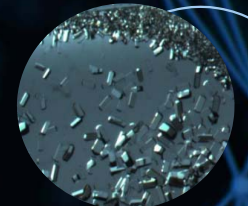
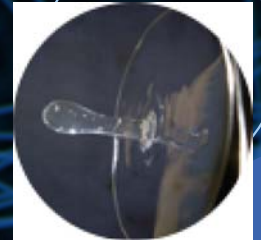
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R&D LIFE SCIENCES

- Pharmaceutical / Drugs R&D
- Biotechnology
- Organ-on-a-chip
- Microbiology / Cell biology
- Protein crystallization
- 3D Tissue Engineering / 3D bio-printing
- Micro-encapsulation
- Medical devices
- Cancer / Stem cell R&D
- Nutraceuticals R&D
- Plants / Agriculture / Horticulture

R&D MATERIALS / PHYSICS

- Novel & Smart Materials
- Additive manufacturing
 - Nanoparticles
- Soft matter / Fluids / Foams / Emulsions
- Coatings / Catalysts
 - Oil & gas
 - Cosmetics
 - Food
 - Photonics
- Optical fibre





Our goal is to make **space** a part of **everyday value chains** in research & technology.

ICE Cubes provides a unique service:

- **Regular** access to space
- **Fast**
- **Simple**
- Applying **standard interfaces** as used on Earth
- Providing **real-time** commanding and data access from your location
- Secure reception of **IP data**

We provide support to users in the development of space instrumentation and manufacturing equipment.

ICE Cubes has a **strategic partnership with ESA** and is an accredited **implementation partner** with the **US ISS National Lab**.



Easy and fast-track access to flight opportunities for universities, research centres and companies

For research, technology testing, and STEAM



Design at company ,
university, agency
or any organization



Launch



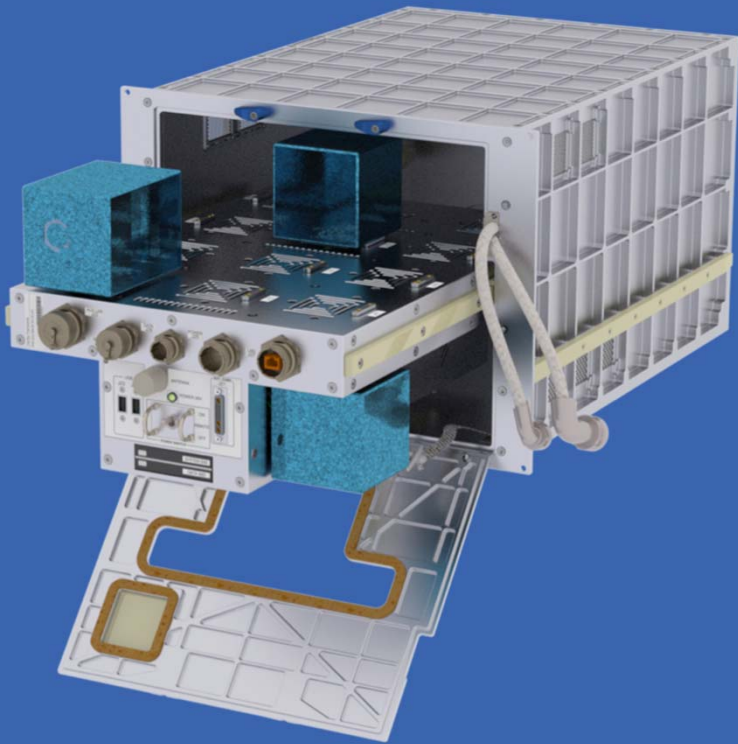
Install by crew
if applicable



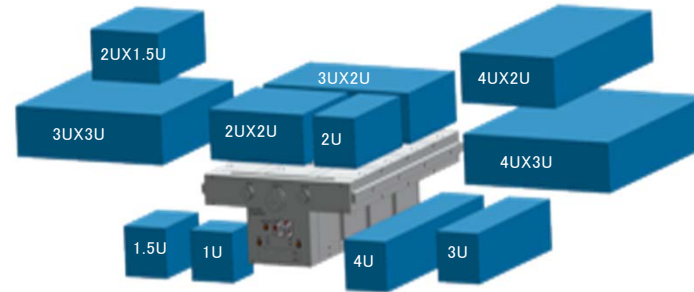
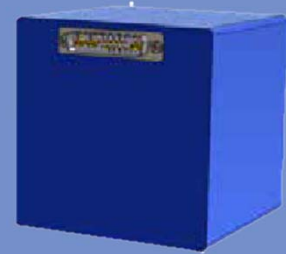
Operate from user's
premises

Users can develop their own experiment and remain owners of their results.





Experiment Cubes using one single connector for both power and data

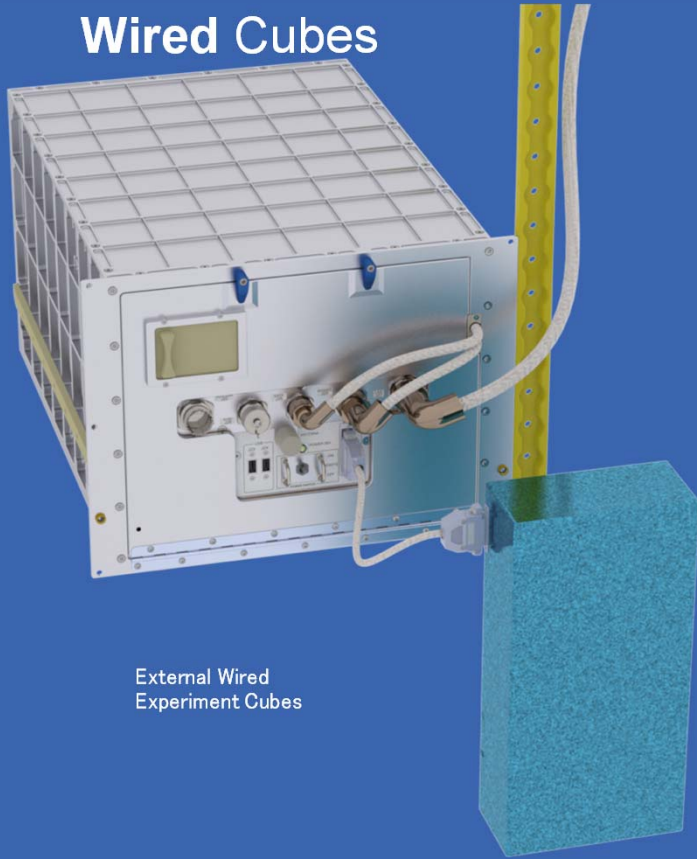


Size of the Experiment Cubes set to mimic the **CubeSat standard**, i.e. 10x10x10cm (1 litre) for a 1U Cube, 20x10x10cm for a 2U Cube, etc, with a max of ~45 x ~35 x ~30cm





Wired Cubes



External Wired Experiment Cubes

09-Jul-2019



Credits: NASA Spharres

Wireless Cubes



Credits: NASA Astrobee

External Wireless Experiment Cubes (images courtesy ESA-NASA)

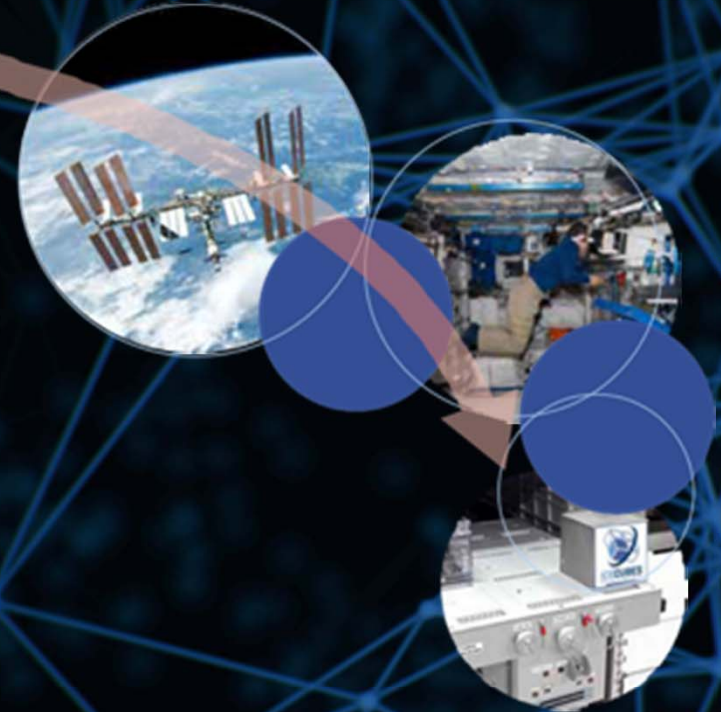


Special Cubes

ICE CUBES SERVICE OPERATIONS AND COMMUNICATIONS



- ICE Cubes Mission Control Centre powers on-off the various experiments and opens the communications lines
- Users directly interact with their experiments from their premises via Internet



To control their Experiments, users are provided with an out-of-the-box software suite composed of VPN client, FTP client, Web browser, Mission Control System client and User Manual



ICE CUBES SERVICE – EXAMPLE USE CASES / AREAS TECHNOLOGIES

Demonstration and validation of technologies, processes and systems in relevant space environment / TRL raising IOD / IOV

Key features of solution:

Use space environment to test new technologies related to e.g.:

- Radiation hardened electronics
- High performance computer systems / miniature space computers
- Autonomous navigation capabilities / autonomous rendezvous & docking / constellation flying
- Miniaturized space robotics and

Validated space technologies for cubesats / satellites

Key features of solution:

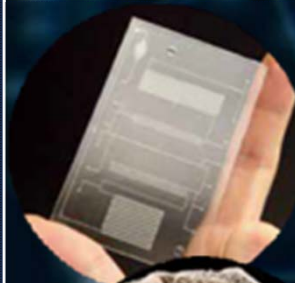
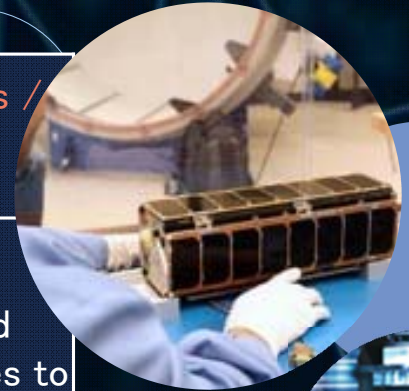
Use space environment (with standardized form factor) to validate space technologies to raise TRL level

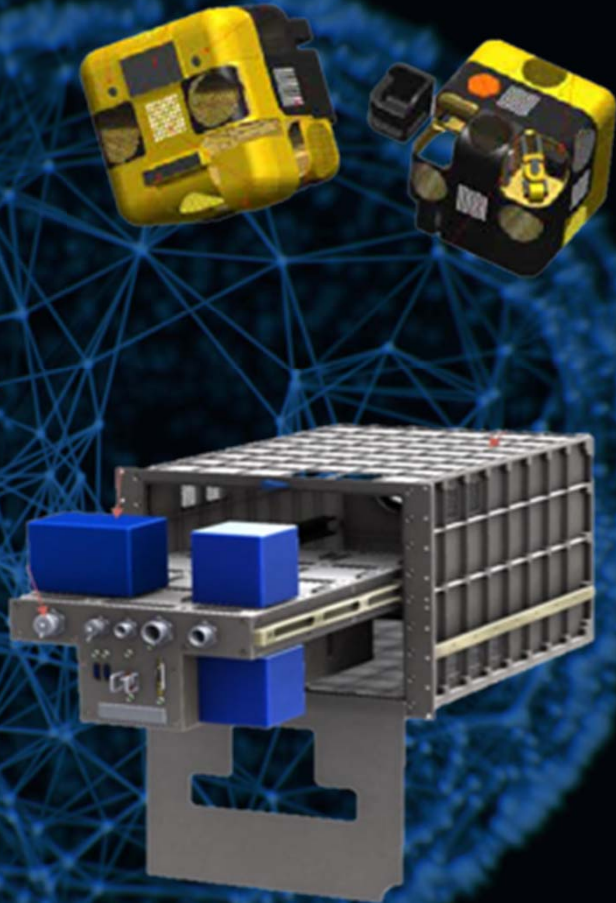
Fast-track validation of manufacturing technologies and new materials

Key features of solution:

Use space environment to validate manufacturing technologies:

- 3D printer validation in space

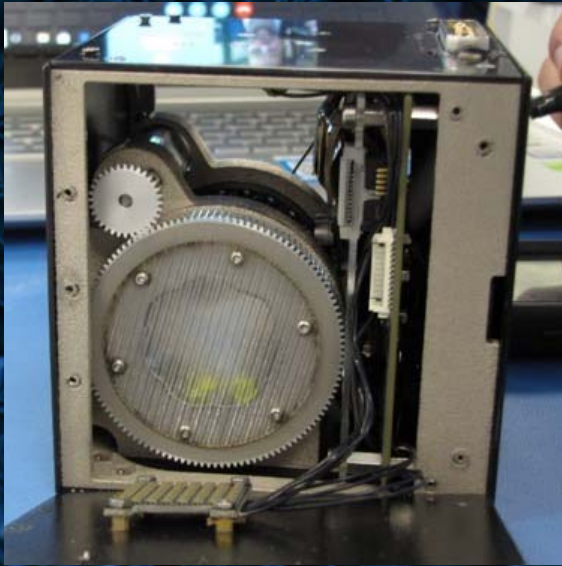




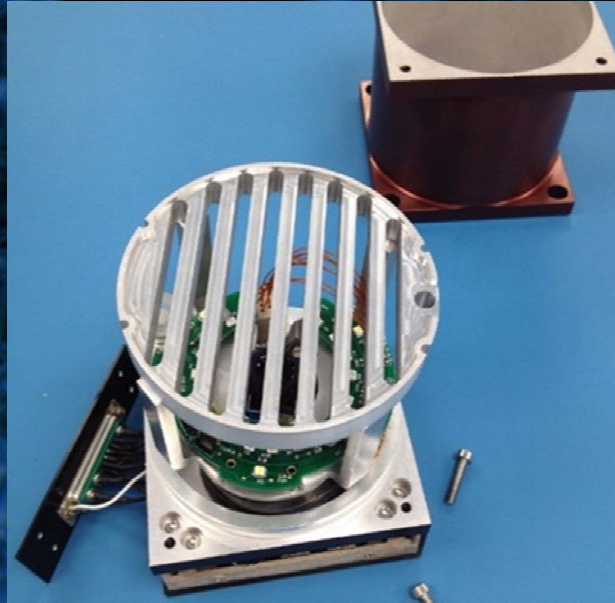
Wireless controlled experiments :

- Testing guidance and navigation algorithms / strategies, in areas of **autonomous technologies** in formation flying, collision avoidance,
- Proof of concept for **miniaturized docking / berthing / capturing subsystems**
- Test of life support technologies for monitoring and analysis of crew vital performances (e.g. supported by AI and supervised from ground)

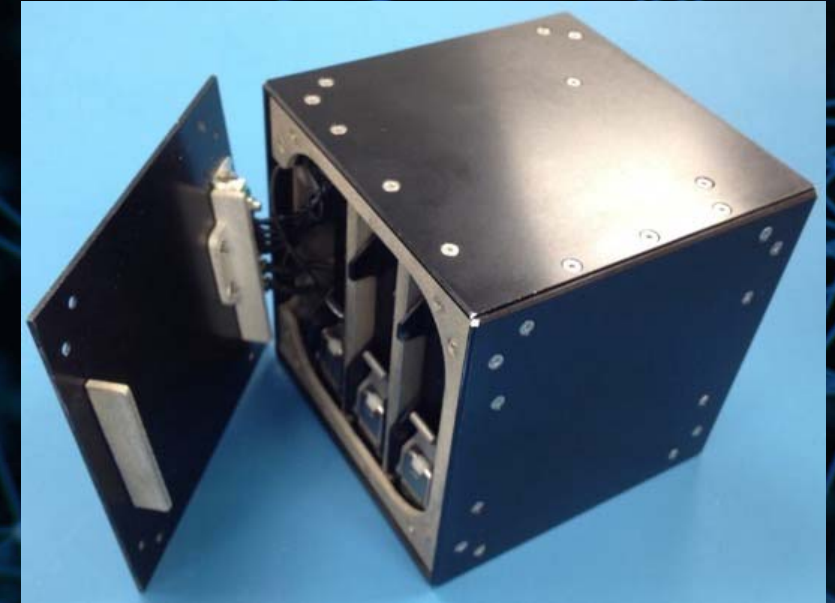
Art inspirational cube:
kaleidoscope and camera /
detection and recovery from
Single Event Upsets



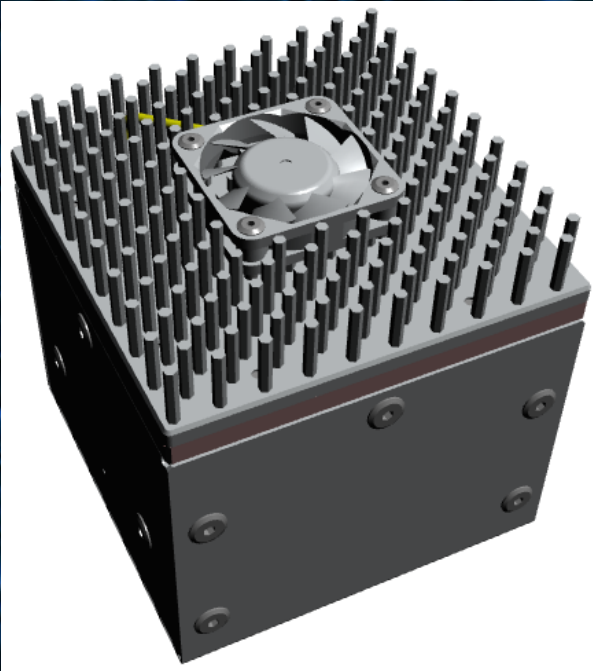
Greenhouse "cube": effects of
 μ /radiation on plants
germination and growth



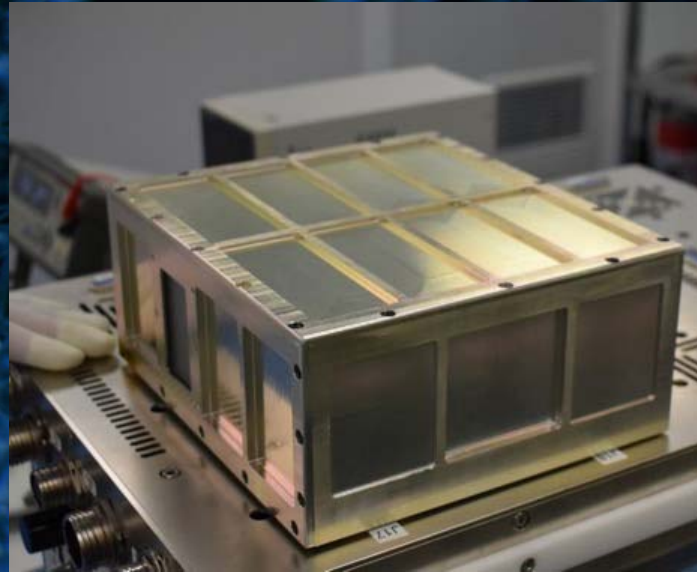
Growth chambers cube: effects of
 μ /radiation on methanogen
bacteria /DNA



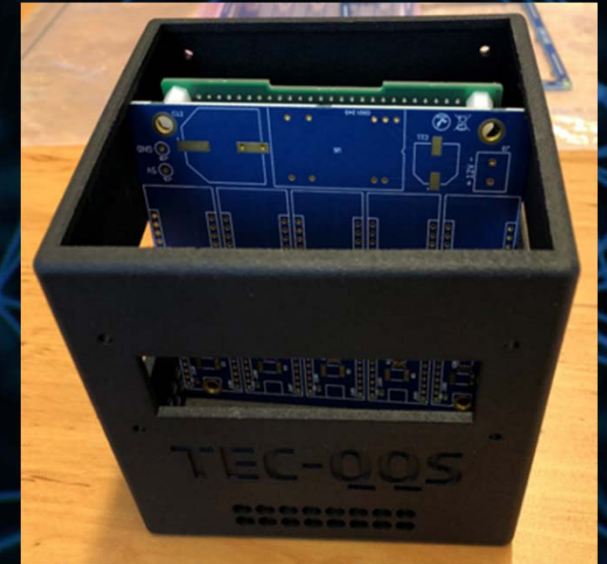
Incubator cube: **protein crystallization** in μg at controlled temperature



Spectrometer and optical fibre switch (in support of ESA's future Exobiology Facility)



Cyber security : key recovery protocol from Single Event Upsets / effects of radiation



OUR EXPERTISE FOR YOUR EXPERIMENT



TO FLY YOUR PAYLOAD
GO TO OUR ICE CUBES WEBSITE

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WWW.SPACEAPPLICATIONS.COM

WWW.AEROSPACEAPPLICATIONS-NA.COM

