



Are we there yet?

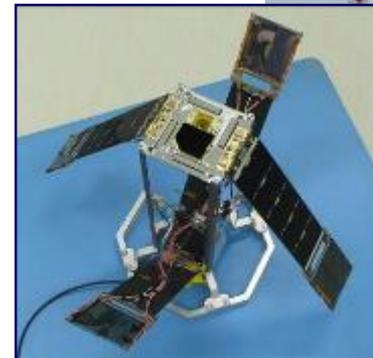
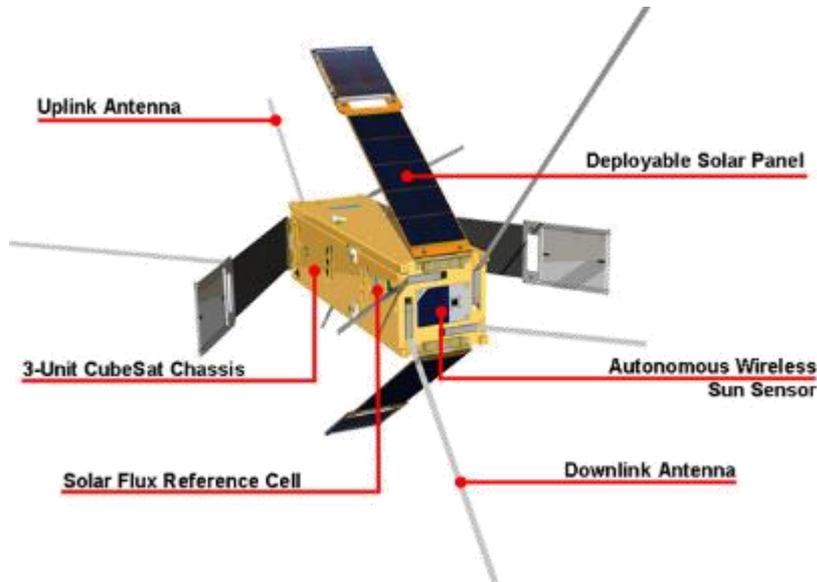
Looking Back at a Decade Of Disruption of the Space Market Using Cubesats

A long time ago...



November 2004 - Delfi-C3 Starts

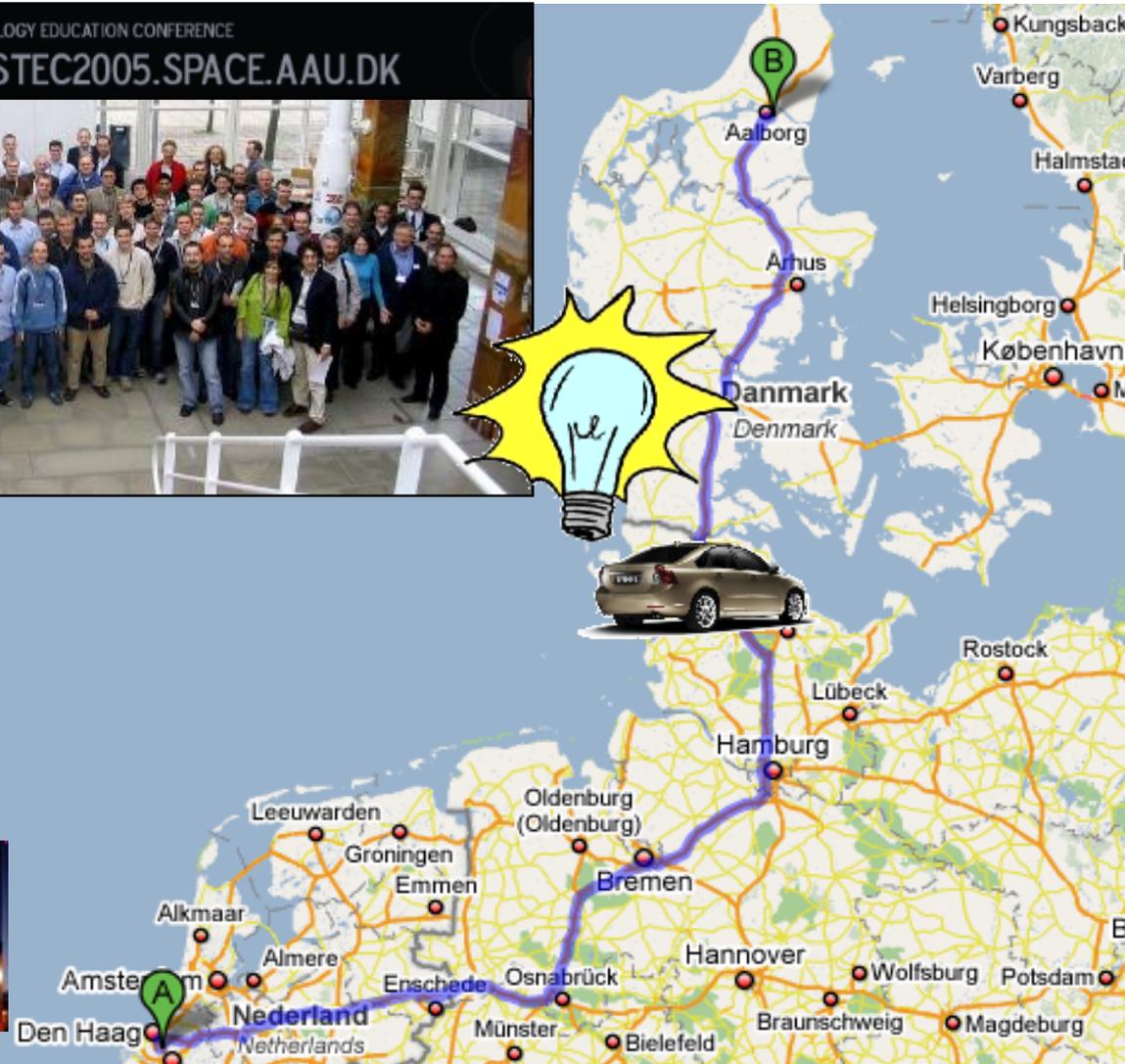
- 4th Dutch Satellite after ANS, IRAS and SlosSat
- 1st Dutch university satellite to be actually launched in to orbit (28 April 2008)
- Project largely run by students
- Industry payloads



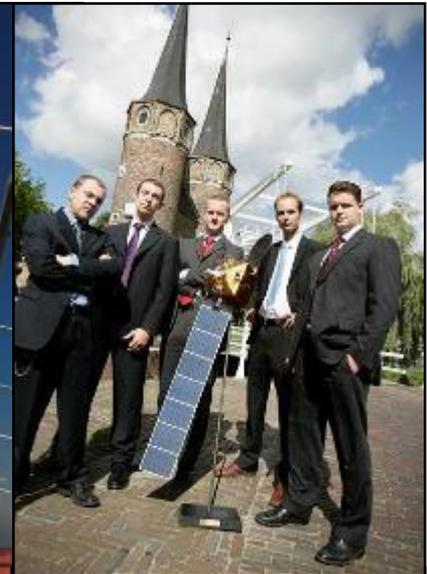
Delfi-C3 Students at work



April 2005 – the idea was born



January 6, 2006 – ISIS founded



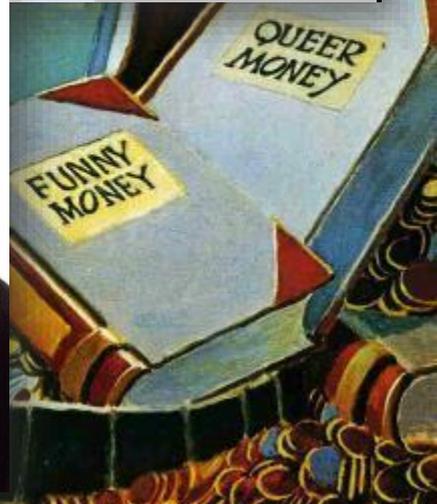
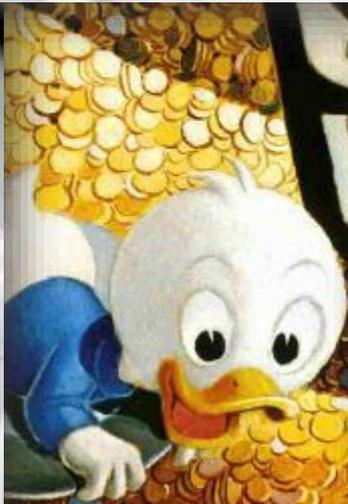
Young Entrepreneur Ruimtevaart

Delftse branie brengt doorbraak
in markt voor kleine satellieten

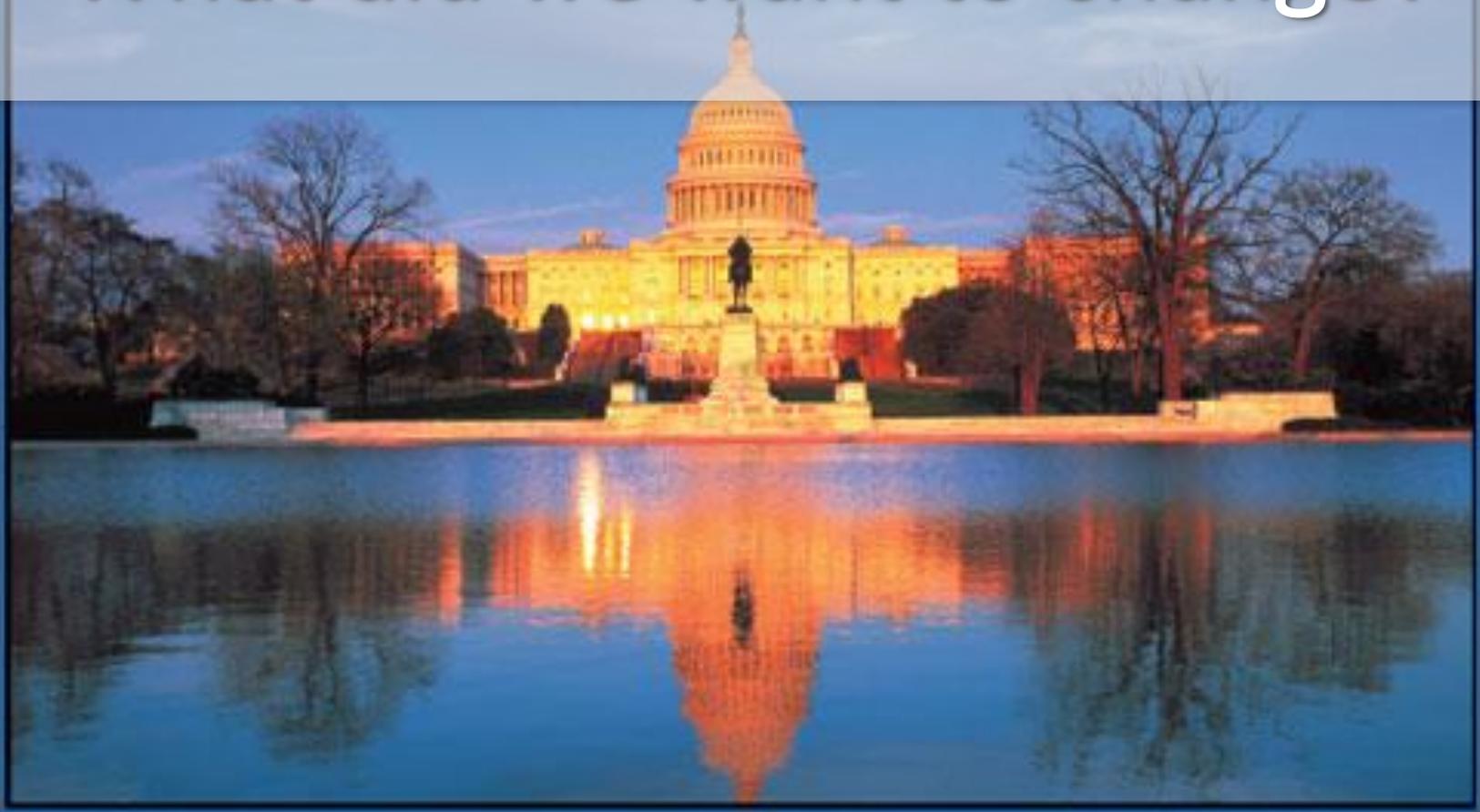
Why start a space company?

The best way to become a millionaire in the space business is to start as a billionaire...

... space is a great way of losing a lot of money real fast....



What did we want to change?



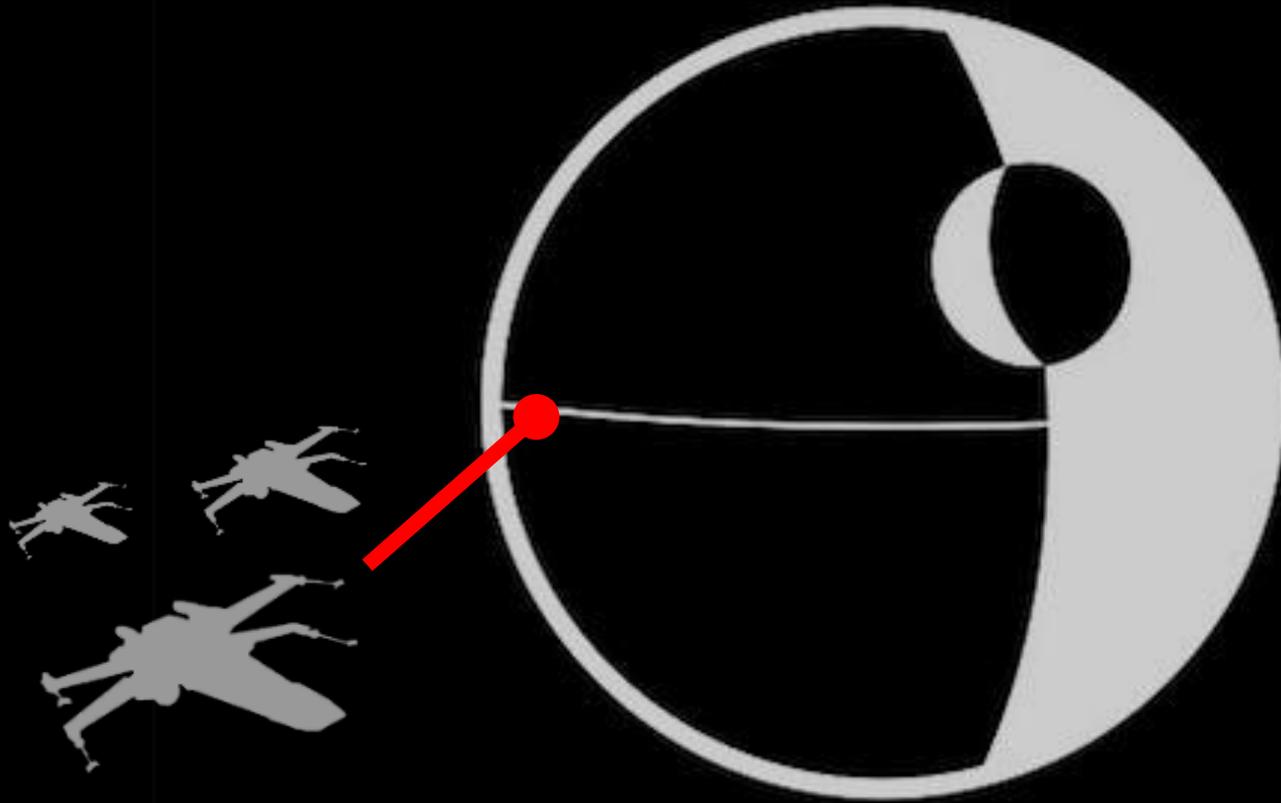
GOVERNMENT

IF YOU THINK THE PROBLEMS WE CREATE ARE BAD,
JUST WAIT UNTIL YOU SEE OUR SOLUTIONS.

What did we want to change?

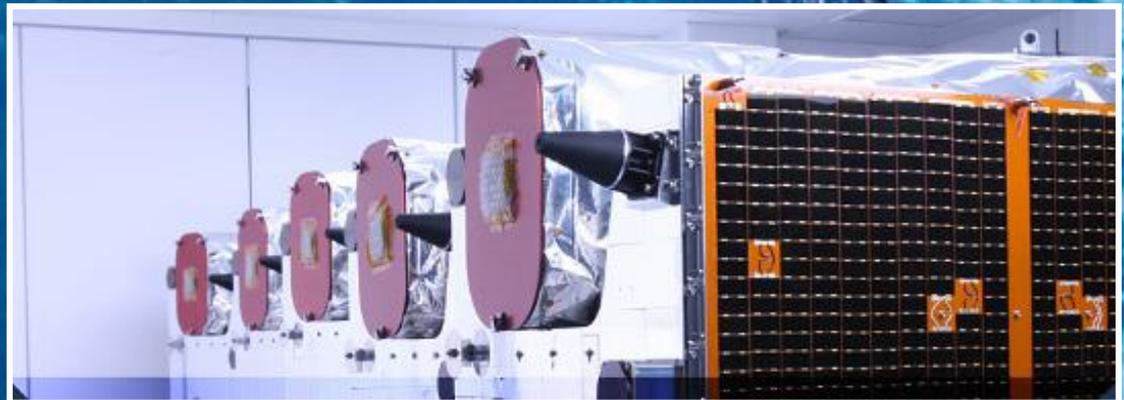


What did we want to change?



TOO BIG TO FAIL

A Market for Smaller Satellites



Nanosatellites and CubeSats

modular spacecraft



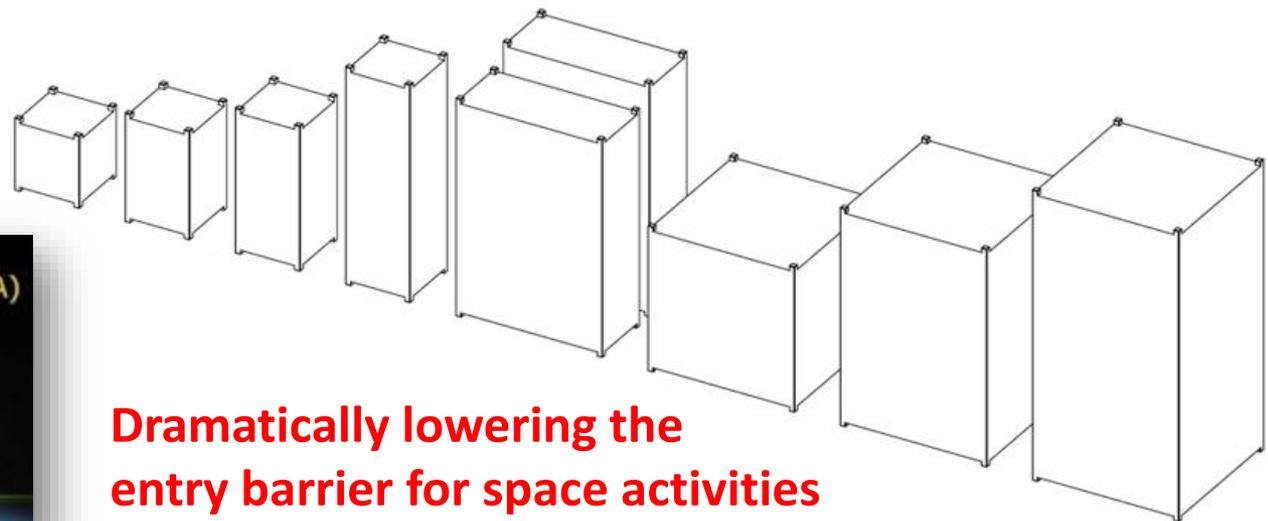
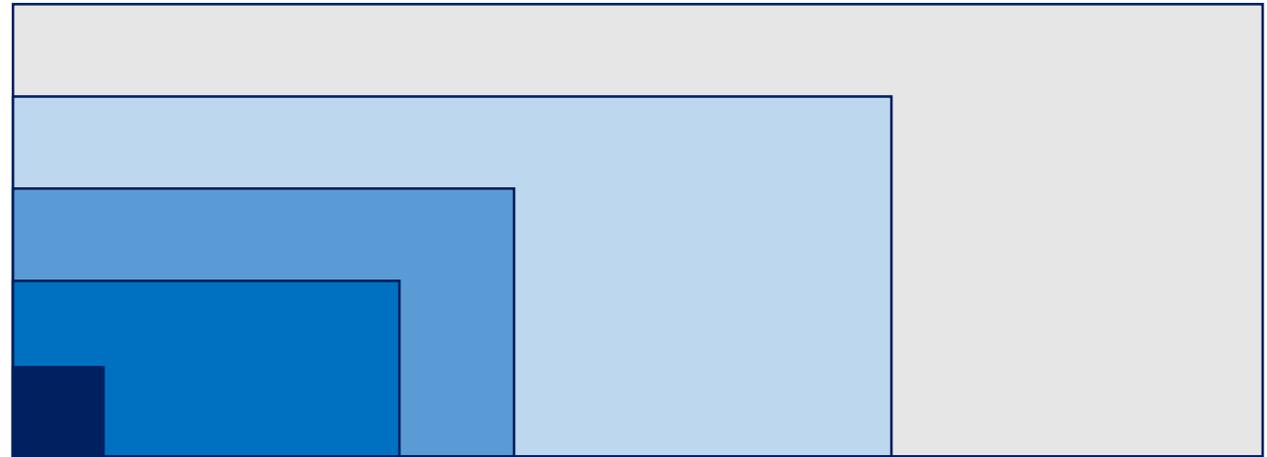
< 100 kg Microsat

< 50 kg Small Microsat

<24 kg Large Nanosat (12U CubeSat)

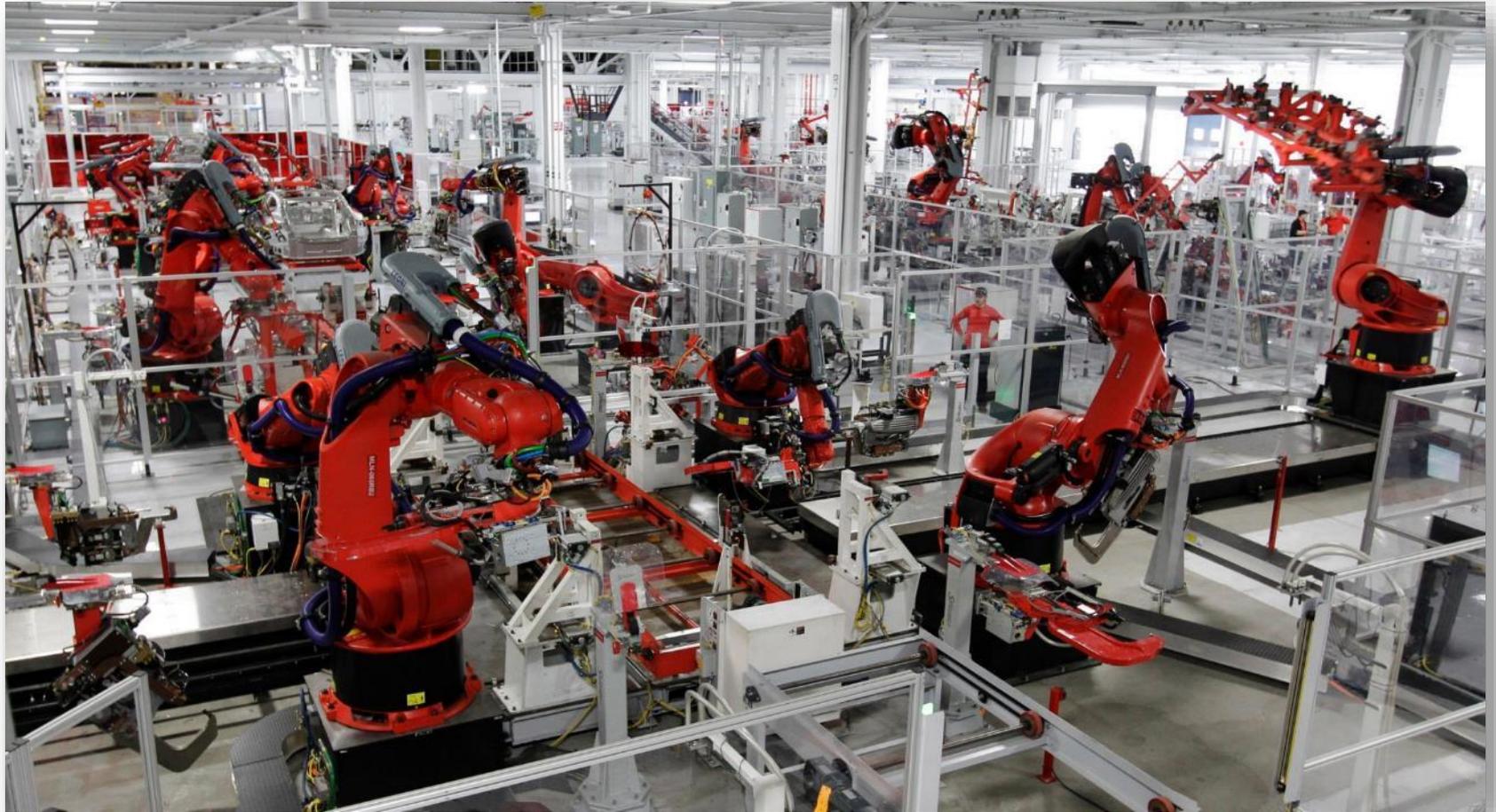
<10 kg Nanosat (6U CubeSat)

<1 kg Picosat (1U CubeSat)



Dramatically lowering the entry barrier for space activities

The space sector is changing out of the laboratory, into the factory



Innovative Solutions In Space

the nanosatellite specialist



Established in 2006

Small satellite company (1 – 25 kg)

Vertically integrated organization

- Research and development
 - Components and subsystem production
 - Satellite mission design and implementation
 - Satellite launch services
 - Satellite operations
- 65 FTE based in the Netherlands



Standard products



Satellite Solutions



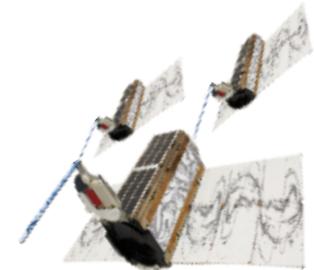
Launch services



Applications and services

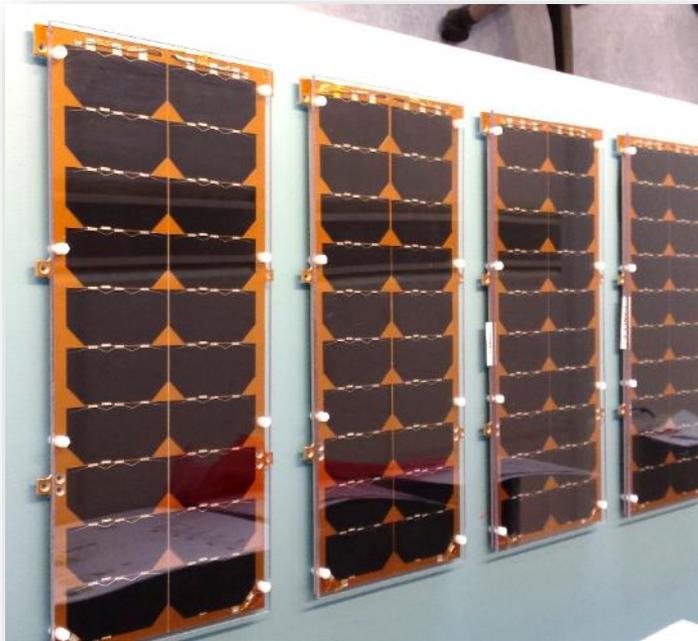
The nanosatellite 'revolution'

disruptive concepts in the space sector



How long does a revolution last?
How long can you disrupt?
When are we becoming 'the establishment'?

Small satellite products off-the-shelf standardized parts

A screenshot of the CubeSatShop website. The header features the "CubeSatShop" logo on the left and the word "PRODUCTS" on the right. Below the header, there are two main navigation options: "One-stop webshop" and "Standardized products". The "Standardized products" section is expanded, showing a list of product categories with corresponding images of the hardware. The categories listed are: Antenna systems, Attitude actuators, Attitude sensors, Cameras & payloads, Command & data handling, and Communication systems. Each category has a right-pointing chevron icon next to it.

CubeSatShop PRODUCTS

➔ One-stop webshop ⚙ Standardized products

- Antenna systems >
- Attitude actuators >
- Attitude sensors >
- Cameras & payloads >
- Command & data handling >
- Communication systems >



COTS Hardware – instant delivery?



In fact most COTS systems are built-to-order



PRODUCTS

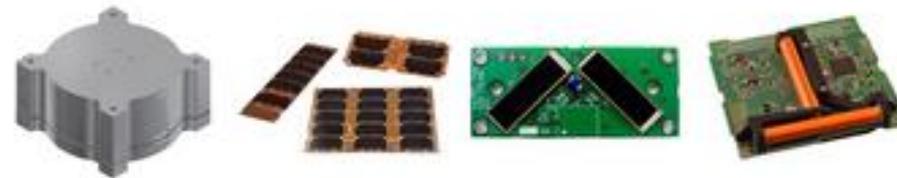
➤ One-stop webshop

⚙ Standardized products

Antenna systems >



Attitude actuators >



Attitude sensors >

Cameras & payloads >



Command & data handling >

Communication systems >

CubeSat kits & buses >

Change in CubeSat Applications



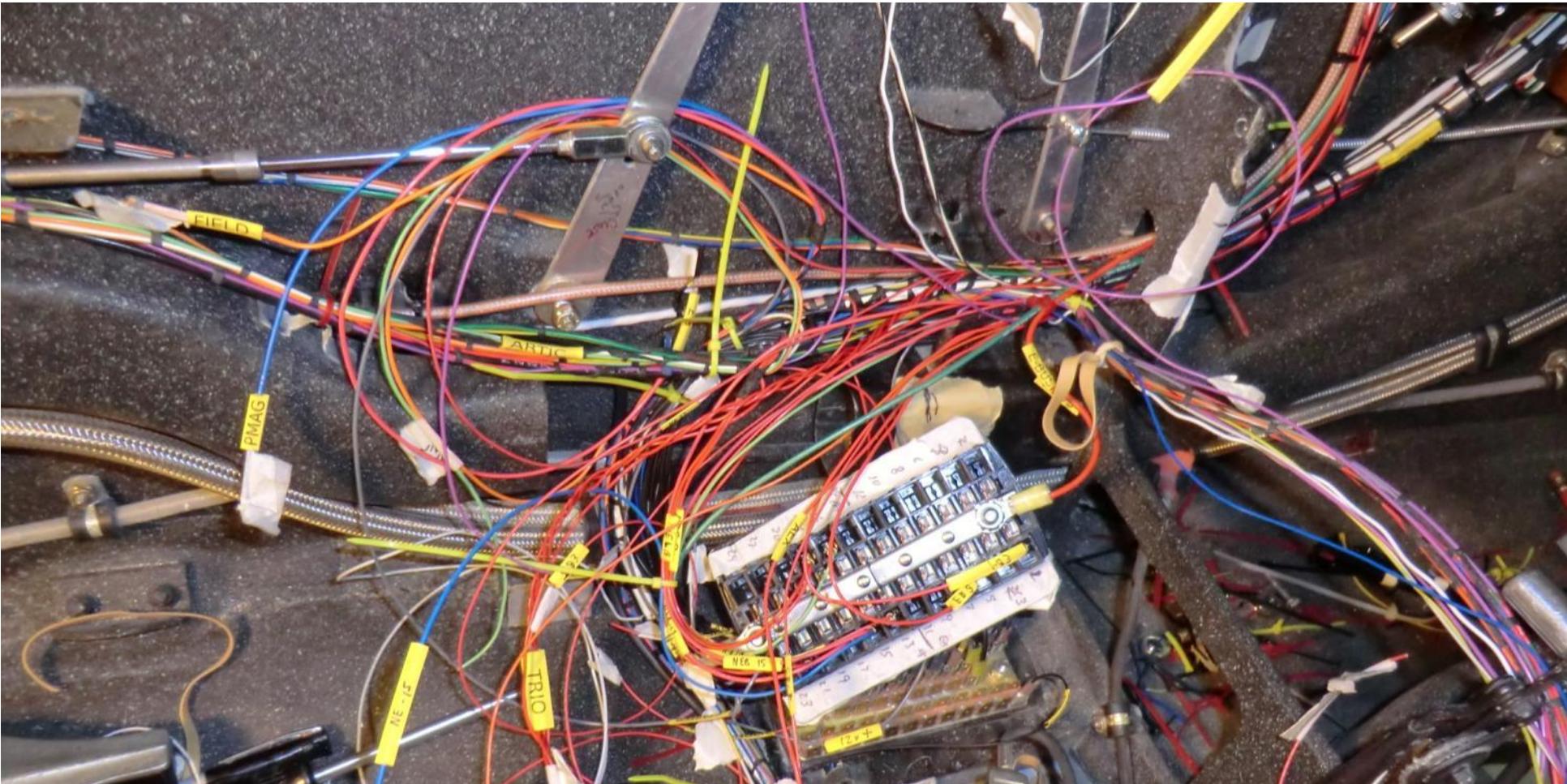
Where does COTS hardware fit in?

- From a low cost educational tool...
(DIY) → COTS used as a backup
 - ...to a constraint-based, cost-effective LEO demonstrator...
(live with its limitations) → Prime use of COTS
 - ...to a niche market, full-fledged space solution
(more classical design approach) → Integrated COTS avionics
- ... Large risk of mixing or switching design approaches creating programmatic issues

Plug&Play: all COTS are compatible



Typically across product from the same vendors



Paperwork is evil, or is it?



COTS alleviates recurring documentation burden



With more at stake (commercial) or different environments (non-LEO), CubeSat QA/PA may have to be beefed up

Golden Rule: Stick to the CubeSat Spec!



But be flexible to avoid costly NRE

1U

1.5U

2U

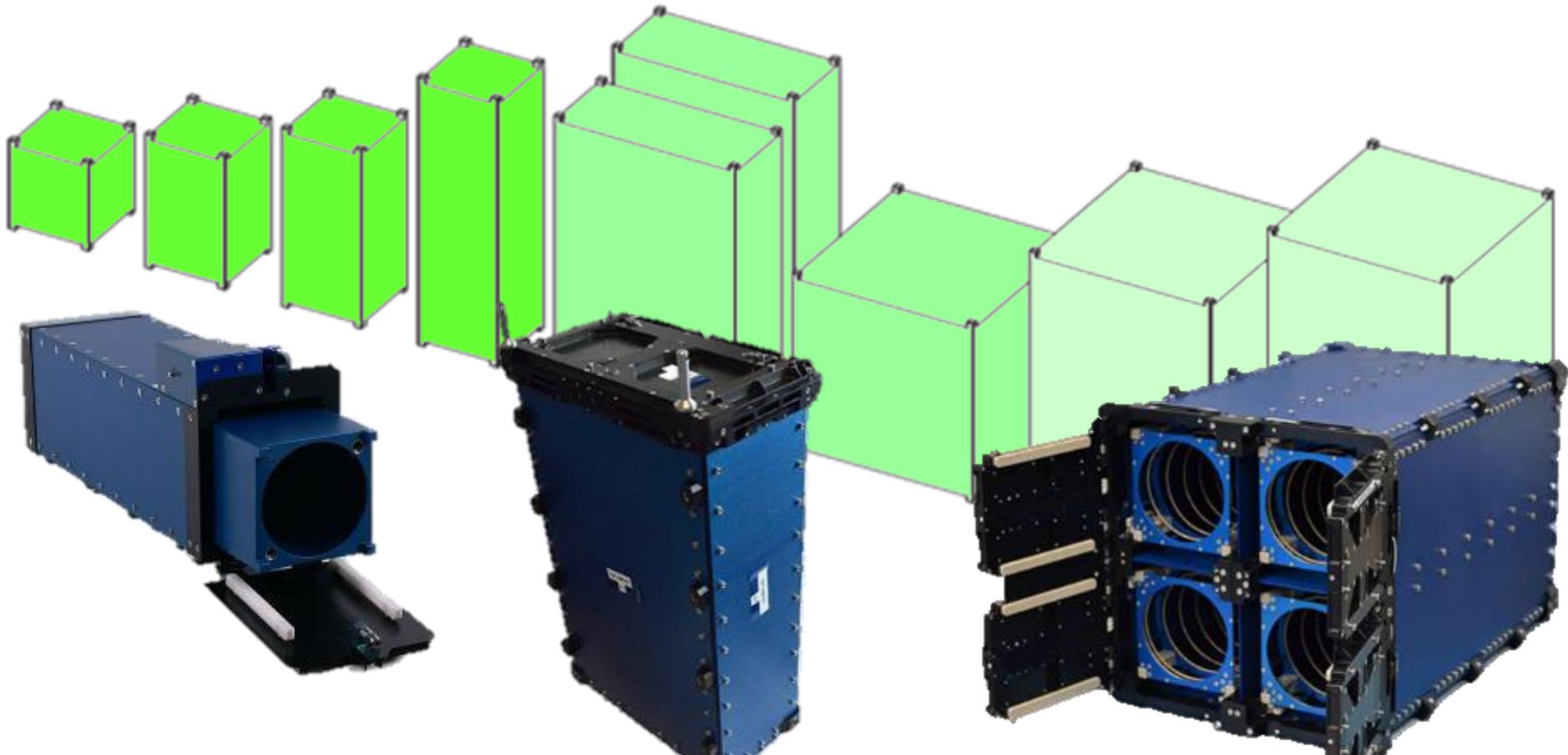
3U

6U

8U

12U

16U



Customers...



CubeSats serve a large number of different ones...

- Universities and student teams
- Institutes
- Space agencies
- Government customers
- Aerospace customers
- Services companies
- Individuals / crowds
- Volunteer organizations

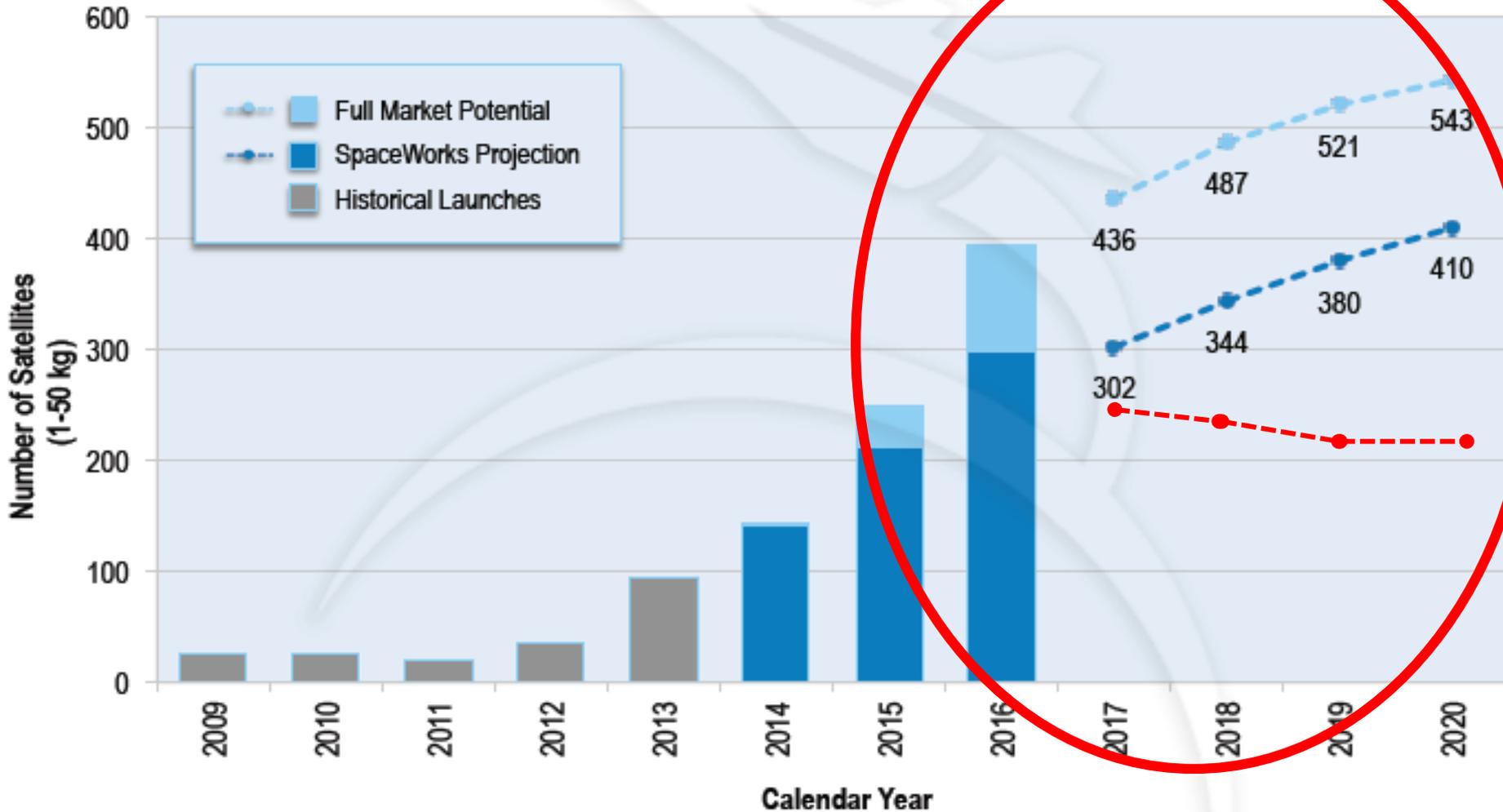
"The customer is always right," is half a sentence. The rest of it is, "if the customer is reasonable and not an idiot"



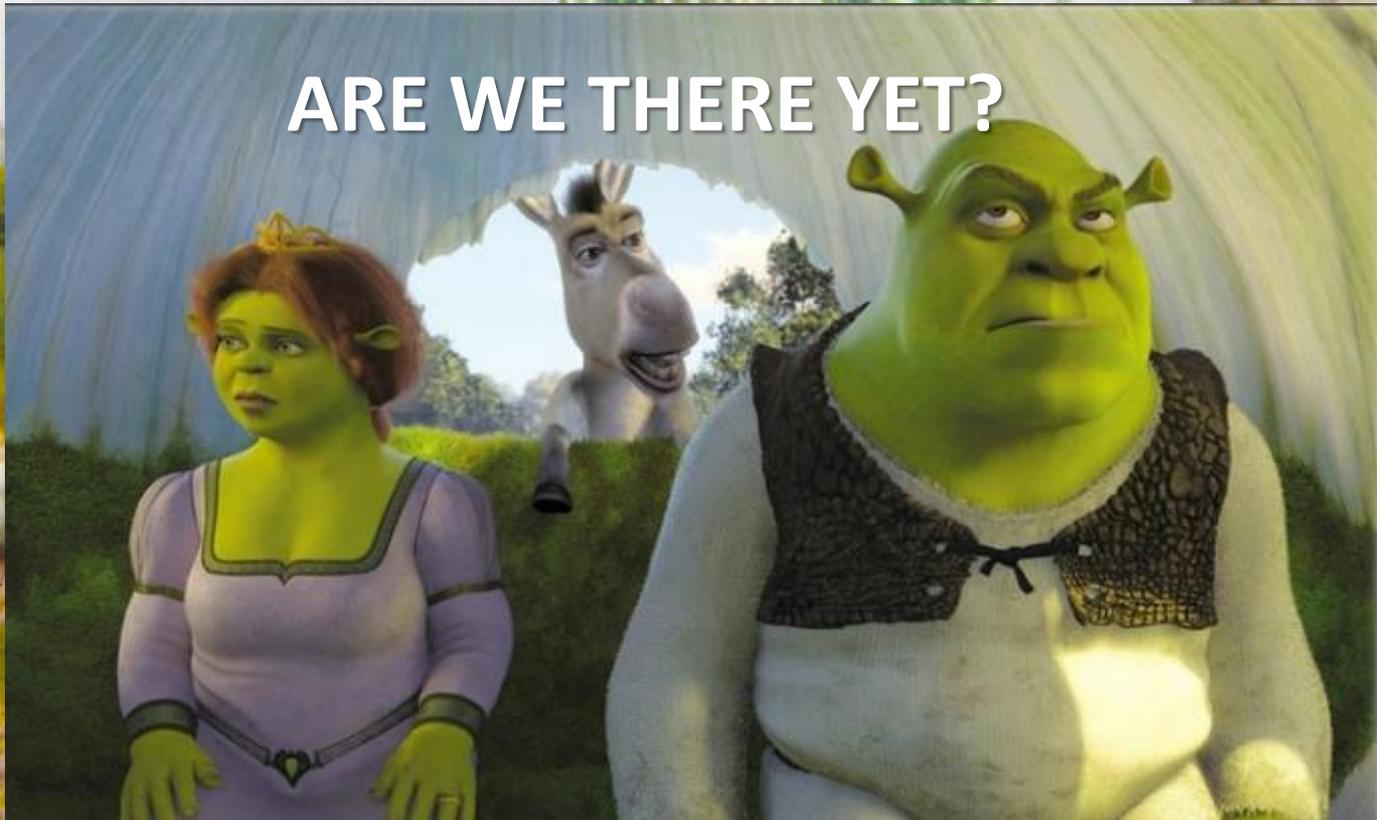
Different customer types have different requirements, background knowledge, expectations, processes, etc.

Difficult to cater to them all, real risk for misunderstanding each other in the process of doing a Cubesat mission.

A growing market nanosatellites take flight



The Road Ahead



Things coming our way

What is on the immediate horizon?

- Non-LEO missions and all that comes with that
- Real commercial / operational utility
 - Constellations, large data volumes
 - Life cycle cost engineering
- Full embedding in agency programmes
 - Planetary Exploration
 - Earth science
 - Climate
- Rules and Regulations
 - Operations (national space acts, spectrum, liability insurance)
 - Debris Issues (Mitigation Techniques, Space Traffic Control)

Conclusions and Lessons Learned

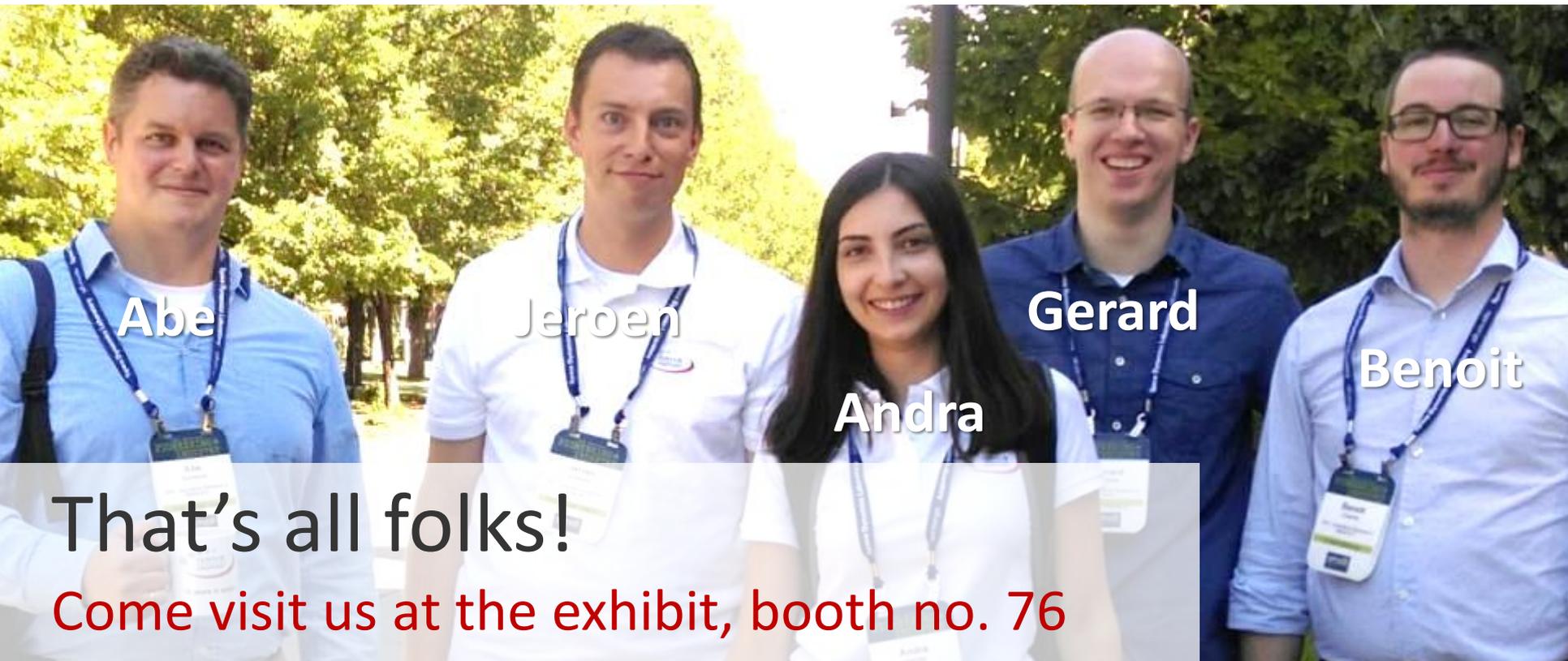


Looking back at an exciting decade of progress

- We have come a long way in 10 years
- We have made space accessible again for new entrants
- We have found real uses for CubeSats
- We have embedded them in agency projects
- We have established a real space business sector
- We have inspired institutional and traditional stakeholders

- We still have (a few) things to do better, complete, improve

- It is going to be an exciting next 10 years for CubeSats!



Abe

Jeroen

Andra

Gerard

Benoit

That's all folks!

Come visit us at the exhibit, booth no. 76

info@isispace.nl

www.isispace.nl | www.isilaunch.com | www.cubesatshop.com