Are we there yet?

Looking Back at a Decade Of Disruption of the Space Market Using Cubesats
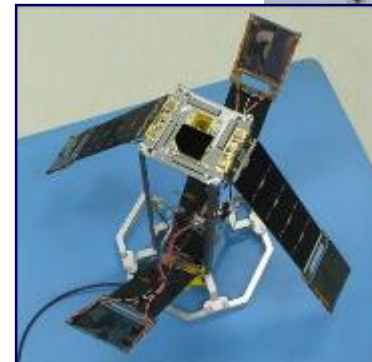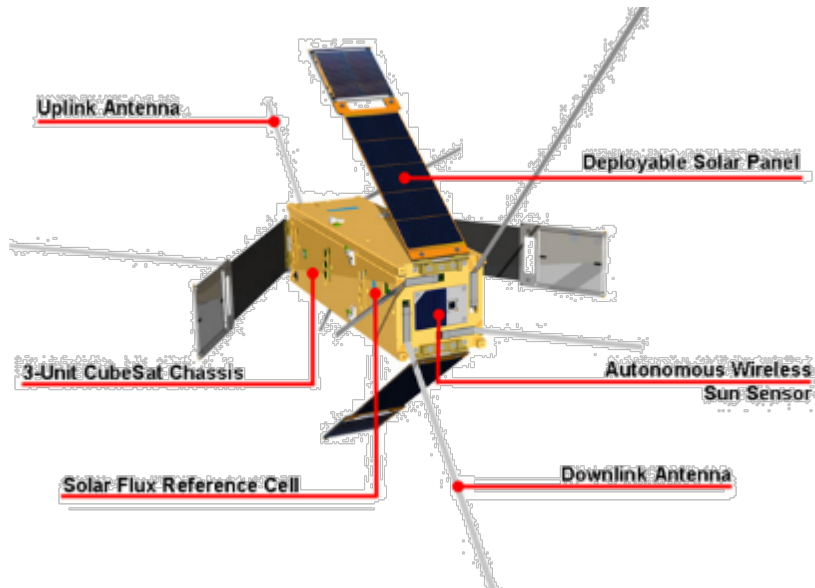
Jeroen Rotteveel, August 6th 2016

A long time ago…

November 2004 - Delfi-C3 Starts

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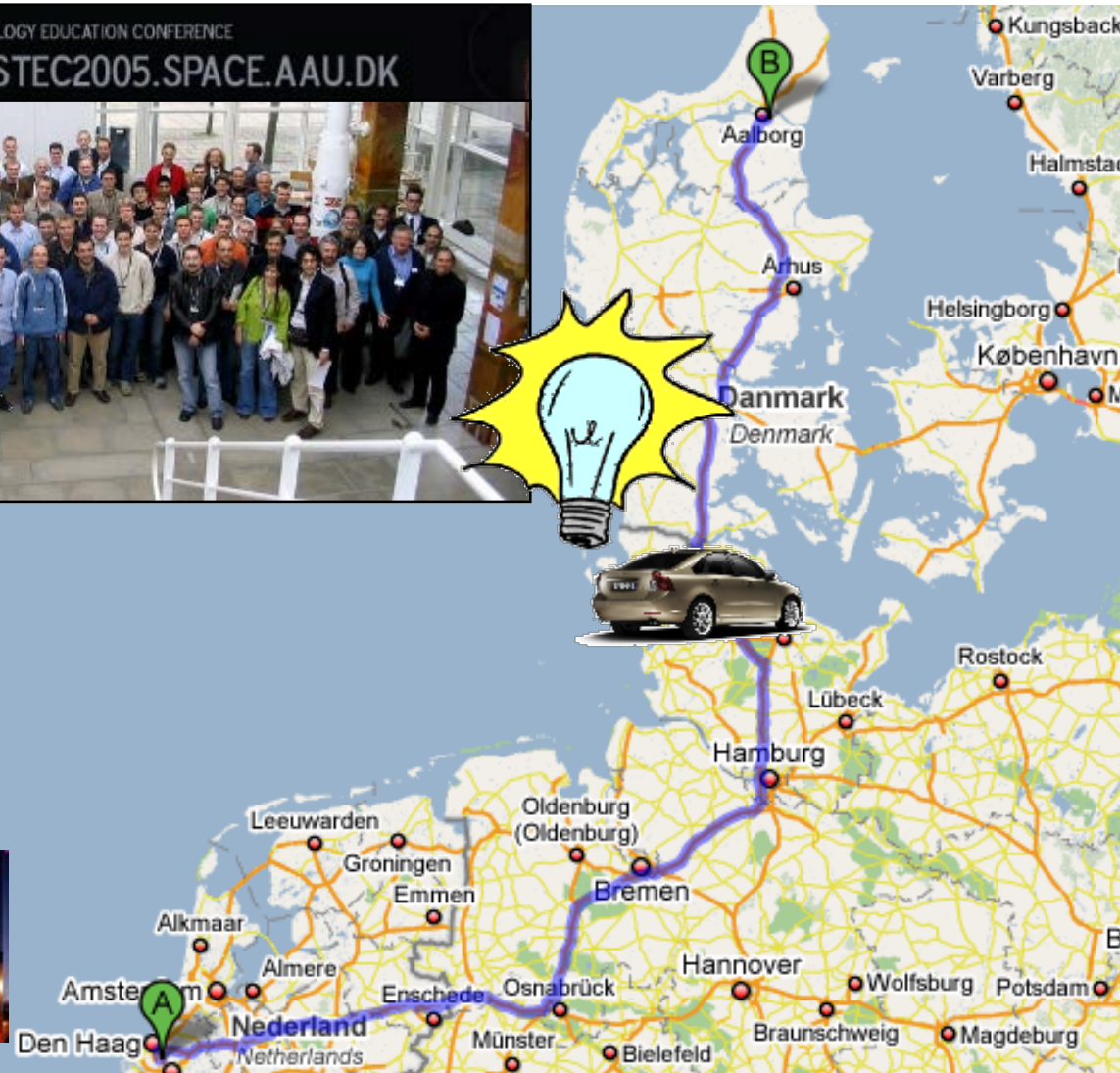- Project largely run by students
- Industry payloads

Delfi-C3 Students at work

April 2005 – the idea was born
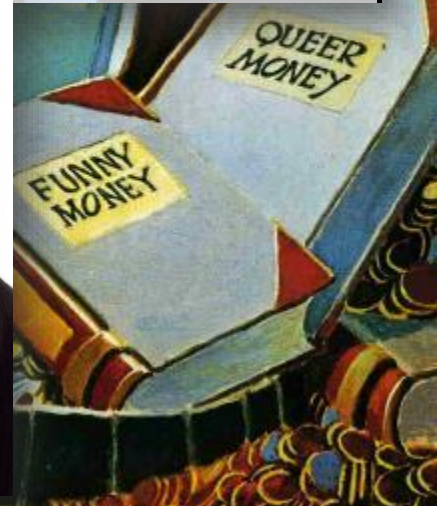
January 6, 2006 – ISIS founded
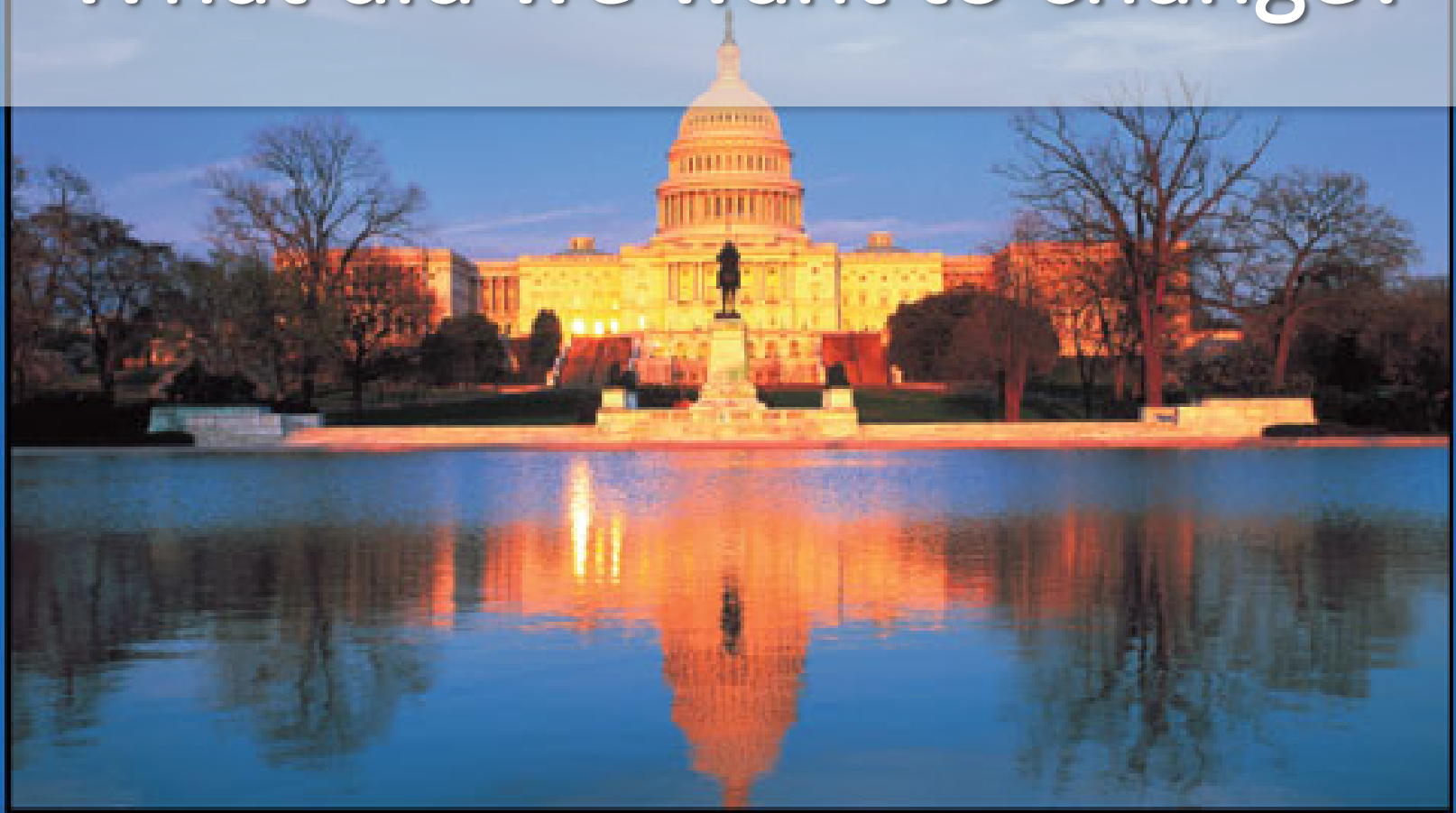
Why start a space company?

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,
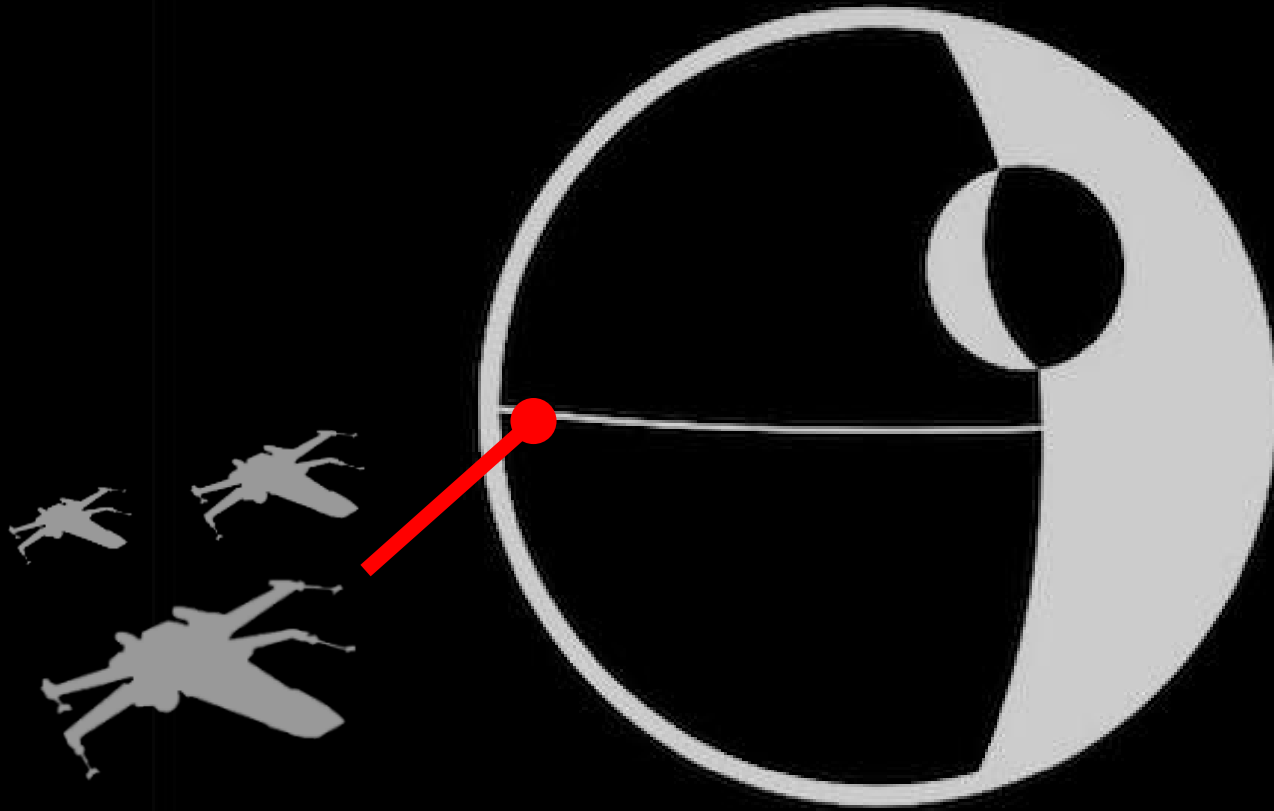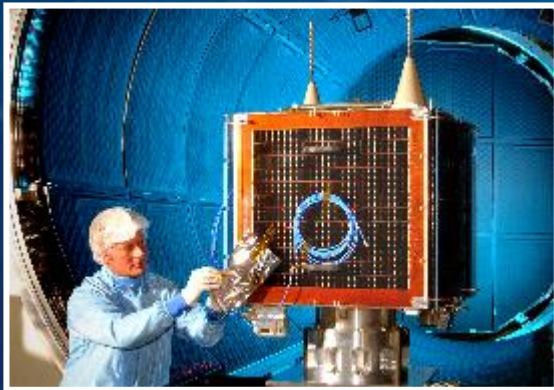JUST WAIT UNTIL YOU SEE OUR SOLUTIONS.

What did we want to change?

What did we want to change?

TOO BIG TO FAIL

A Market for Smaller Satellites
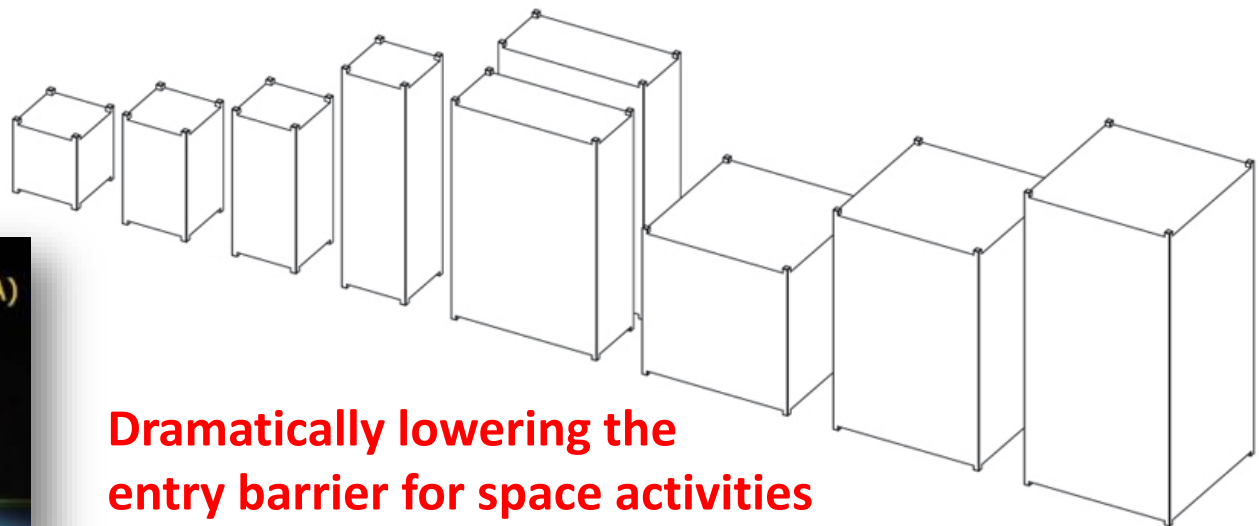
Nanosatellites and CubeSats
modular spacecraft
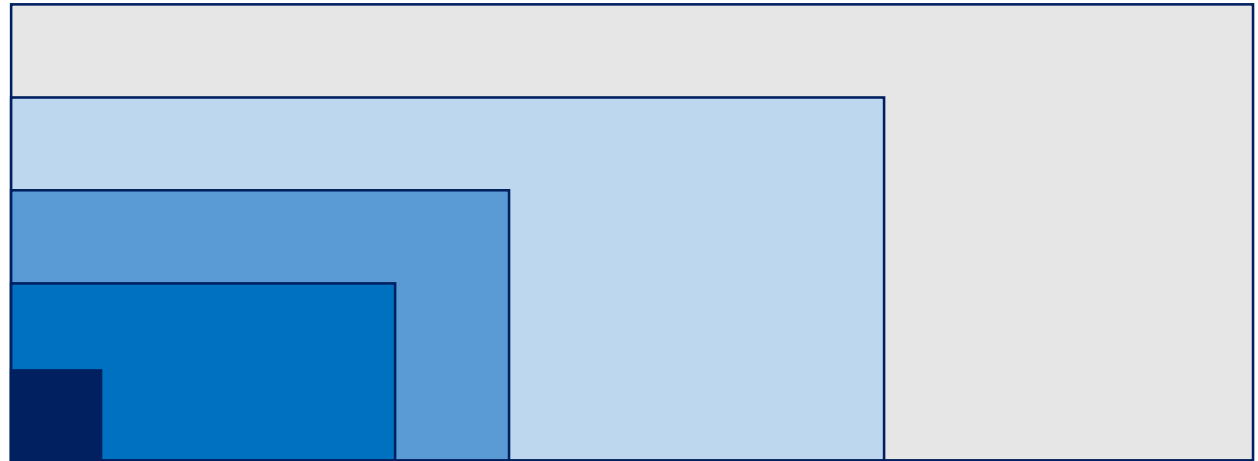
< 100 kg Microsat

< 50 kg Small Microsat

<24 kg Large Nanosat (12U CubeSat)

<10 kg Nanosat (6U CubeSat)

<1 kg Picosat (1U CubeSat)

Delfi-C3   Envisat (ESA)

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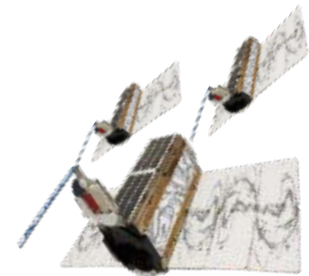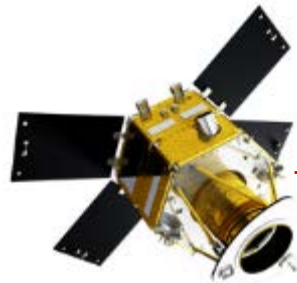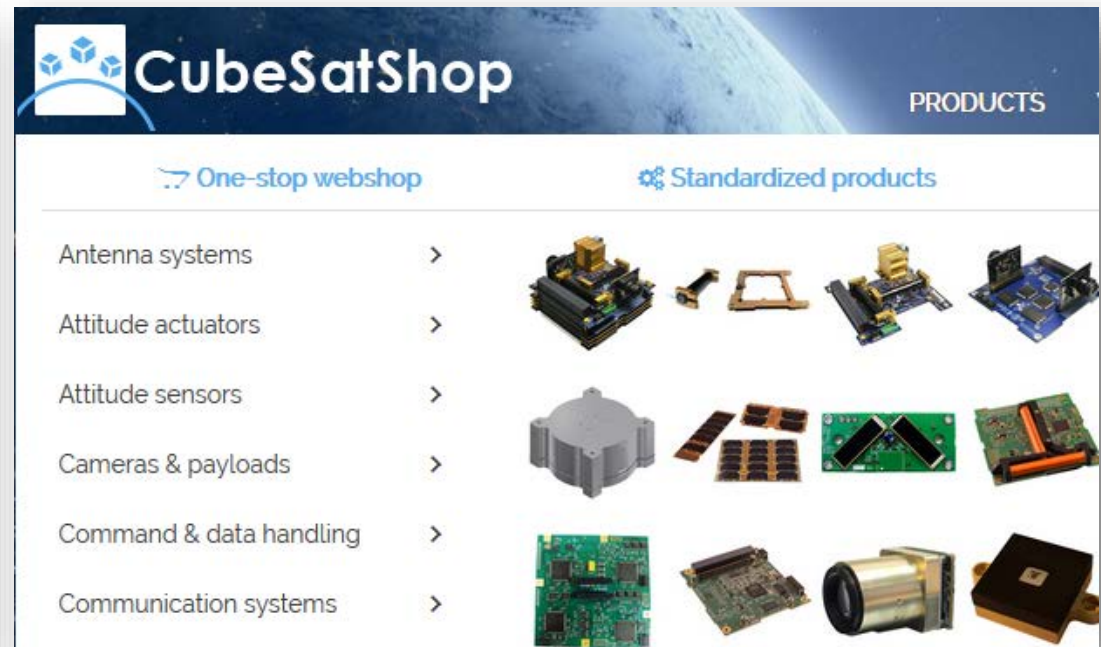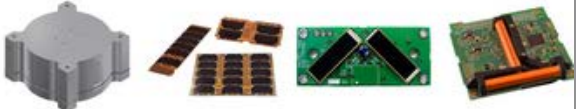
How long does a revolution last?
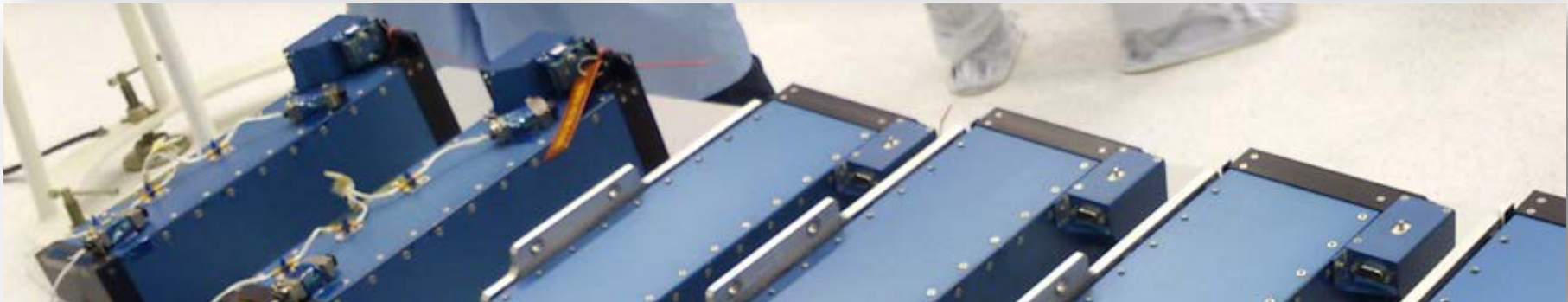How long can you disrupt?
When are we becoming 'the establishment'?

Small satellite products
off-the-shelf standardized parts

COTS Hardware – instant delivery?

In fact most COTS systems are built-to-order

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
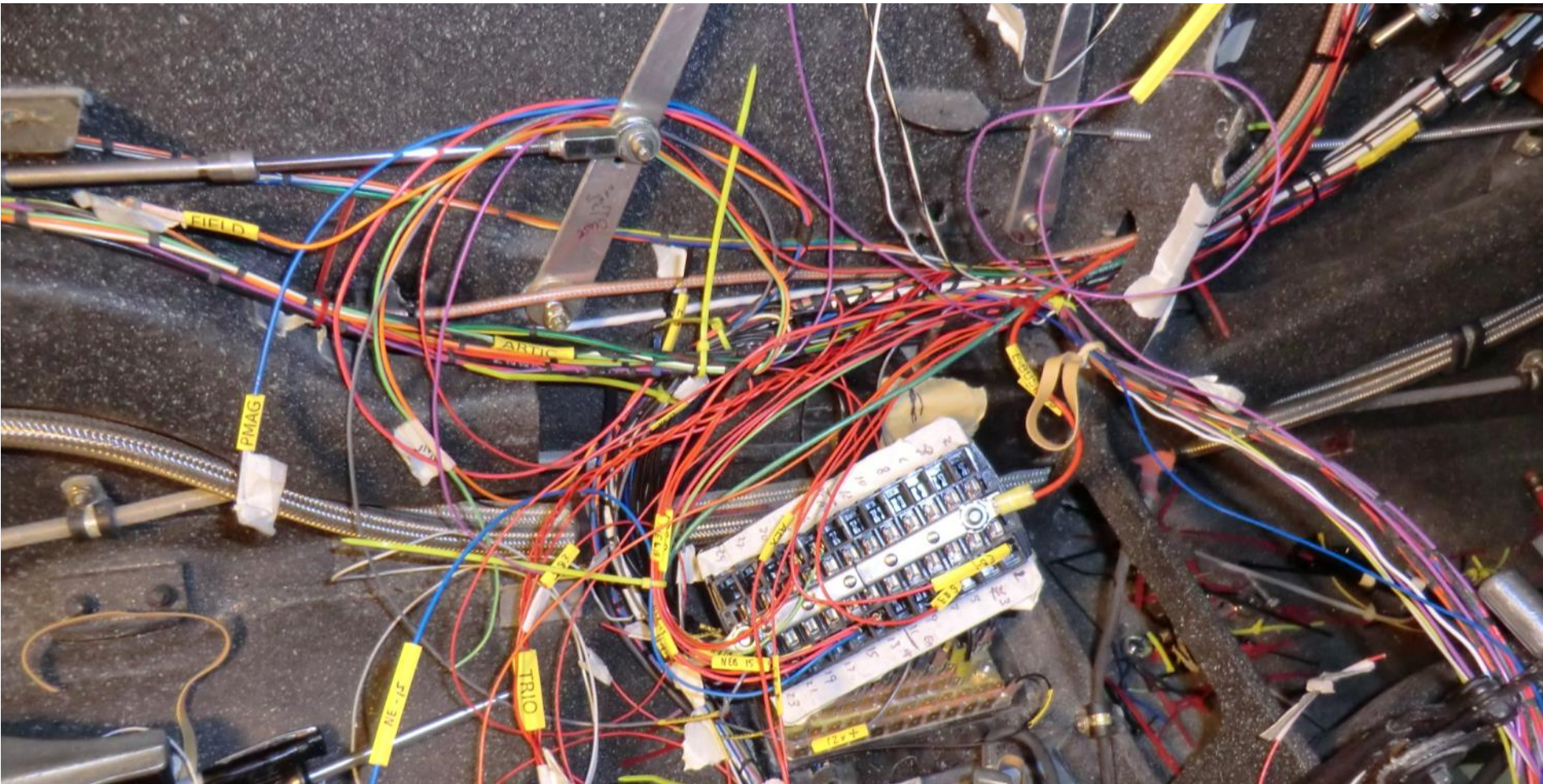
Paperwork is evil, or is it?

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
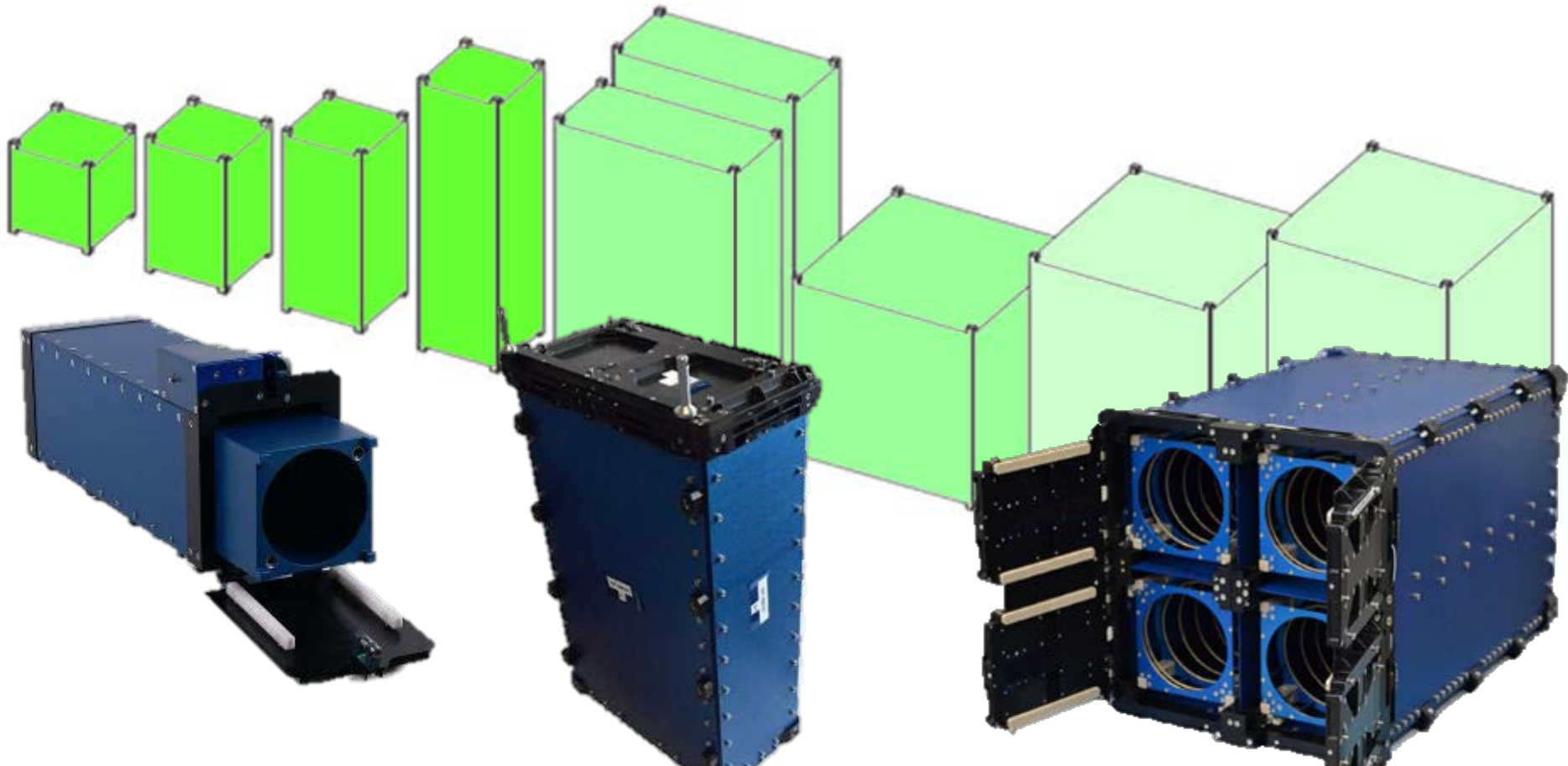- Government customers
- Aerospace customers
- Services companies
- Individuals / crowds
- Volunteer organizations

"The customer is always right," is half a sentence. The rest of it is, "if the customer is reasonable and not an idiot"
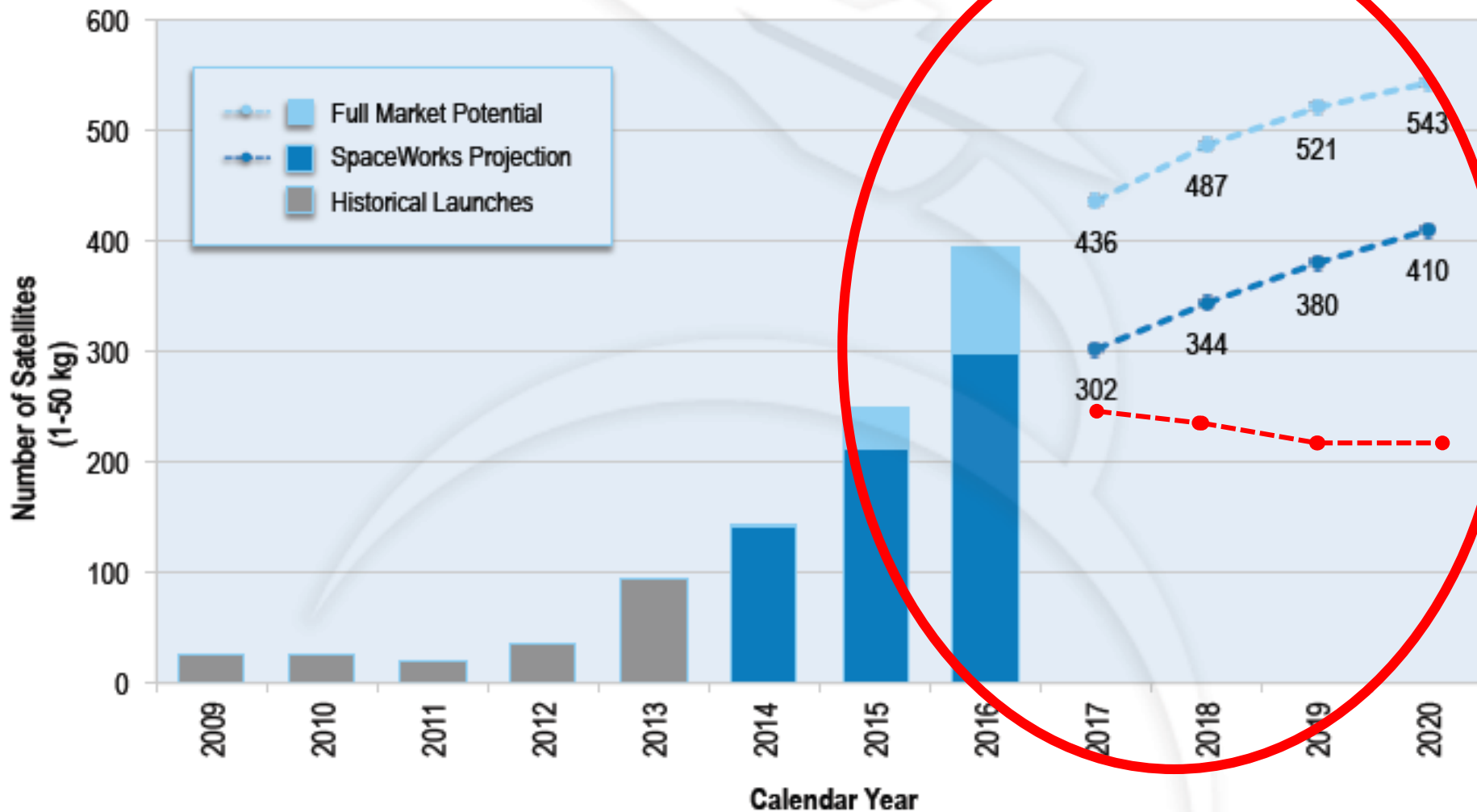
Different customer types have different requirements, background knowledge, expectations, processes, etc.

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

ARE WE THERE YET?

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!
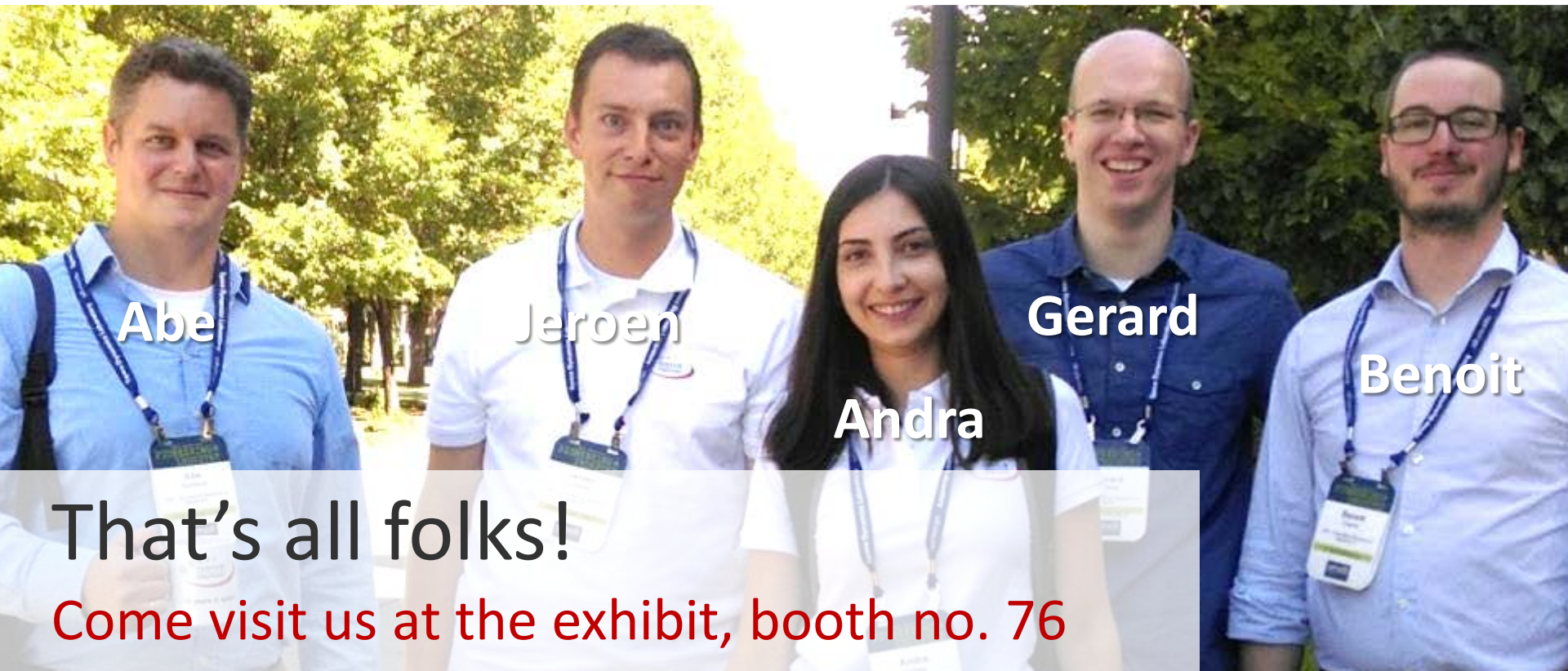
ISIS

Abe Jeroen Andra Gerard Benoit

That's all folks!
Come visit us at the exhibit, booth no. 76

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