Best practices of Studentspace

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by

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- We have been just so lucky many times.

    - Finances

    - Partners

    - Launches

    - Construction

    - Operations

    - Only nice helpfull people around the world !

- But also - If you dont seek the luck you wont get it

Is it still fun after these years ?

- 1992-2006 Ørsted (first danish satellite)
- **2001-2003 AAU Cubesat**
- **2003-2005 *ESA SSETI EXPRESS***
- **2003-2009 AAUSAT-II**
- 2009-2010 AAUSAT-II operations
- 2004-2006 *Baumanetz OBC (lost during launch)*
- 2006-2011 *GENSO global ground station system*
- 2008-2009 AAUSAT3/BEXUS ballon flight
- 2007-2013 **AAUSAT3**
- 2010-2014 DLR-AISAT AIS receiver (4m Ø0.6m helix antenna!!!)
- **2013-2014 AAUSAT4**

- *2012-2016 AAUSAT5/QB50 - withdrawn*
- *2014-...   AAUSAT5 AAUSAT6 (will be delivered bef Christmas)*

- 2002/2011   Best Summer School
- 2005   STEC 2005 ESA student satellite conference
- Five ESA parabolic flights – one invited

- Dont do Satellites

- It takes your time
  - study time
  - free time
  - night time
  - weekend time
- Might prolong your study

- Launch date will evaporate out in the future
  - T+18m
  - Vega Maiden flight T+3Y

- Major part of planning is to head towards stories of succes

- Many small milestones that all lead toward goal.
  - local ballon/range test
  - on earth test of x,y,z ,...

- Management role is to facilitate this for first years as well for last year students

- Succes story may be
  - AT90SAMxxx up and running with OS
  - 3 DOF mag sensor tested with HW
  - EPS seems to do PPT
  - Test report skeleton up and running
  - Track/blog system AND yearly status report
  - Remember and honour all people that contribute
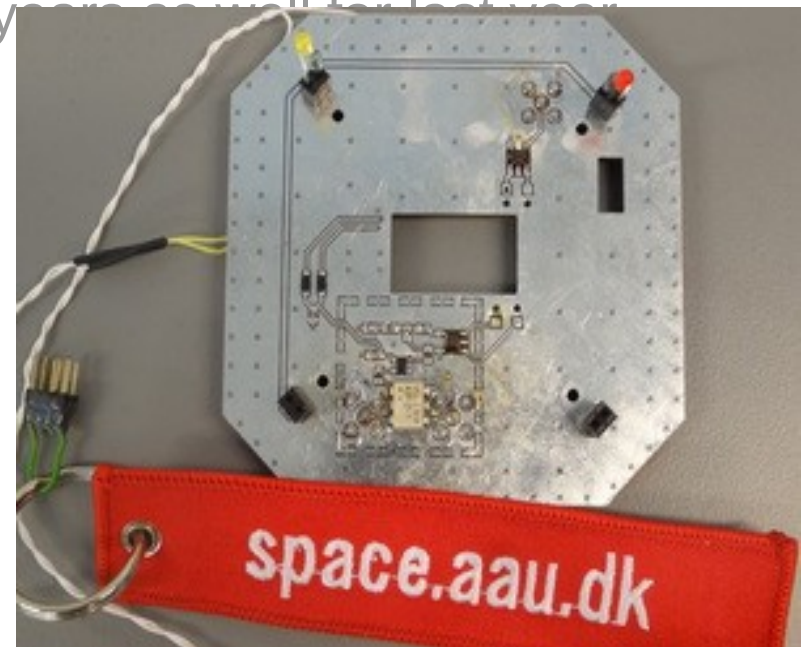
- There shall always be a milestones less then 4 weeks away
  - small milestones
  - big milestones

- Every student that participate shall be able to hand in a milestone
  - web is running
  - SQL is running
  - First OBC mockup works
  - First xxx is in beta1
- And shall do it

- Succes is a **major** driven factor
- And must be **achieved by students**
- not the professors (watch - dont touch)

- Document succes
  - pictures, log, blog, documentation/track,...
  - One day you will miss it for the final mission report
  - In the public - but dont oversell it

- "Document your satellite"

- Prep for conferences

- Team spirit building is invaluable

- Accept all participants if the add to the project
  - some add 20hours/week
  - others add 2 hours/week
  - some for 4 years
  - some for 6 month

- In all cases people has to deliver acc to their engagement and time planning

- Keep planning as simple as possible

- Document it in a simple way - track, blog,...
- Avoid complex profesional tools

  ...

- Remember it is a tough game
- It is much easier to make enemies than friends !
- D.... selection down the line will take place
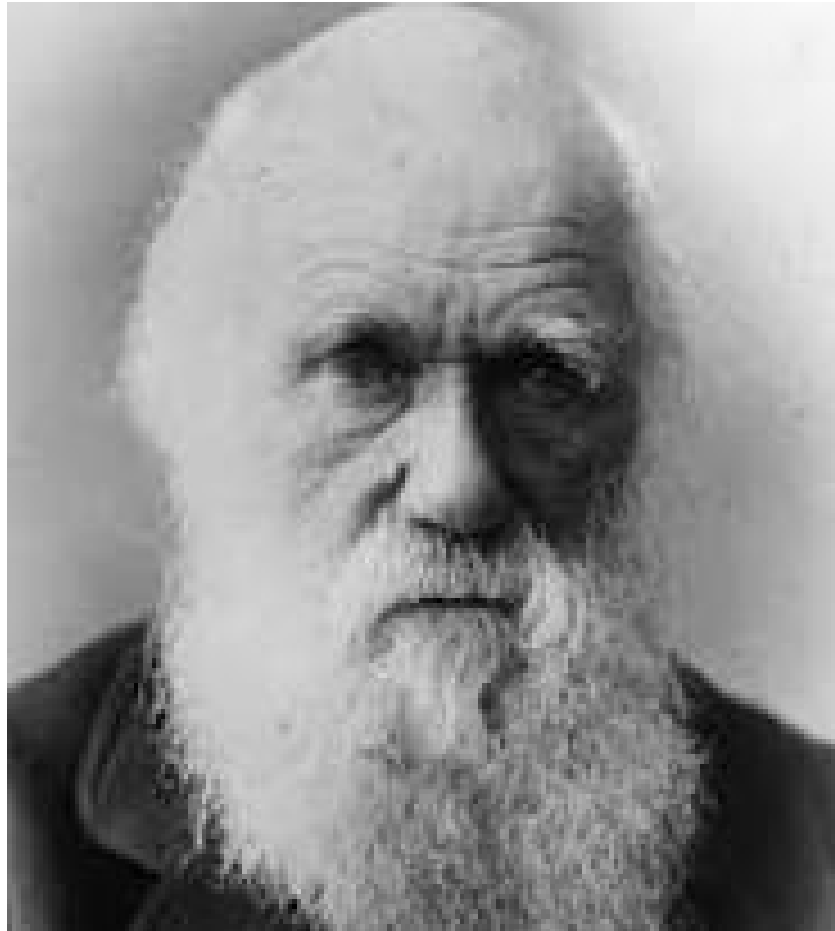
- Let the students take control
- Give the students responsibilities
- Let them run the show
- You are there to
  - help
  - avoid worst mistakes
  - handling conflicts between students (even before they complain)

- AND ...

- Let the students take control
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- AND you shall take the "not so funny" decisions
  - remove deployable solarpanels 3 month before delivery
  - reallocate work when somebody fails seriously
  - Take the decision if students cant find a way to go (dangerous)

- STILL - LET STUDENTS RULE !

- Science path
- Commercial path
- Education path
- For fun path

- Combination hereof

Q: What is the purpose of our missions ?

Concl: Different targets gives different directions

- DIY
- COTS + DIY
- COTS/DNC

Q: What is the purpose of the mission ?

has an impact on selection

of design strategy

- You have to decide from the previous slides

- My personal: we are educating engineers and the satellite will reflect their work and skills - not yours !

- Dont go COTS

- Go DIY

- Find friends around and share (like ESTCUBE-1 and AAUSAT)

- Mission I : to educate the best engineers in the World
  - To give them workman skills in addition to engineering skills
    - which is not possible in normal university education
  - To bring prototypes to High Q systems that can be launched
    - which is not possible in normal university education
- Mission II : to attract new students
- Mission III: industry spin-off around AAU
- mission IV: payload or the sat's

- Means
  - Just do it
  - Let students be in control

- No interest in COTS
- Better own LoFi than
  buy HiFi

- The Journey is the Destination is now **not enough**
  - acc to the students

- A pro payload was now a demand

- and development of a brand new DIY satellite platform

- Not only for fun - was their argument

- Interest from outside for "pro" results
  - (latest contact from China on Monday this week)

- The Journey is still the Destination ???

The Journey is the Destination

-o-

which some people had a problem understanding

- Test test test test test test test test test test test test test

- Plan test while doing design.

- ONE positive test is NOT enough

- We fly significant errors in AAUSAT-II and AAUSAT3
  - AASAT3 error (in protocol SW) has saved mission a couple of times

- And document by pictures etc

- *Beware of Pro institutions ;-) They real test yoru stuff*

- Modular system concept ease
  - design and coding
  - ease (some of the) test

- but might add complexity
  - a distributed system
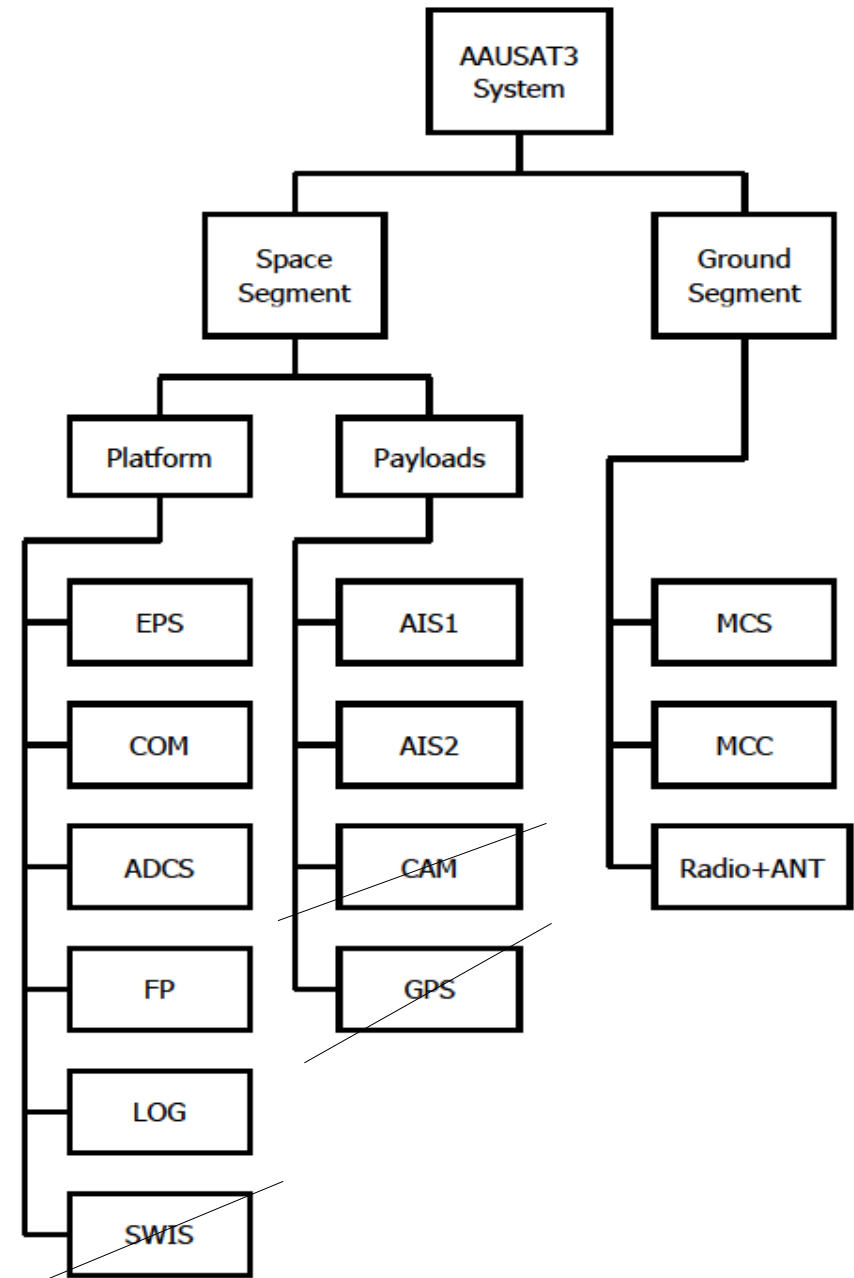
- Take "craftman" skills very seriously
  - learn how to solder (we send students to Hytek)
  - learn how to desing PCB
  - learn how to construct and tune antenna
  - learn how to do side panels, mag coils, coating, gluing, cleaning
  - etc - you just name it

- Learn how to behave in cleanroom
  - including logbook !

- Let students travel alone to ESTEC, launchprovider etc
  - send two or three
  - let professor stay at home
  - do a crash course in "manners" :-)
  - convinse them that they are "good enough"
  - BP to 112 call in evenings

- I have never been
  - at launch site
  - at launchprovider for test and handover
  - ...

- KISS KISS KISS KISS

- Keep it slow
  - it: CPU
  - it: memory
  - it: internal communication

- Only young students do not fear...

  - ADCS
  - Downlink capacity
  - Temperature problems (Drift of frequency etc)
  - Batteries and charging
  - Memory corruption in space

```
int i;

i = 3*4+init(23);

...
```

Morse Beacon Memory Corruption

Our friend from Japan, Toshio Kasei (JA1GDE), reported yesterday that the battery voltage in our morse beacon was suddenly prefixed with the '(KA)' prosign instead of 'B'. Instead of "OZ3CUB Bx.x Txx" the satellite transmitted "OZ3CUB (KA)x.x Txx". The radio stores the morse string as a regular ASCII string in RAM, with the '(KA)' and '(AR)' prosigns stored as the STX and ETX character codes. The difference between 'B' (0x42) and STX (0x02) is only a single bit, so it is plausible that bit 7 in the 'B' character was flipped due to radiation.

We rebooted the radio, which reinitialized the morse string from flash and this fixed the problem. However, this really makes you wonder how many bit flips like this go unnoticed :)

- The happy wild west days might soon come to an end
- or at least change
- Req for documentation, test, component info,...

- If your mind says hmmm - then react on it
- Say it looud and clear
    - I dont like this solution/proposal because....
- An be at same time constructive

- Can be difficult to state this to your fellow students
- But it can be a risk to the mission not to say it

- *Prepare for long discussions*

- Design your mission so you can get results without uplink

- LNAs are more sensitive than PAs (just ask me)

- Launch is a succes
- First beacon is a very big succes
- Autonomous operations is a very big succes
- First uplink is a very big suces

  and your will normally start here bq previous steps are trivial
- control of satellite
- B-DOT detumbling
- ...

130228 Low Voltage(06:08CET)

After receiving one beacon which among other things stated battery voltage below 7V AAUSAT3 no more valid messages was received.

We are looking at it.

130304 ALIVE

T+7 - At forst evening pass beacon from 4th March 2013 - we are in contact again after 4 days silence.

You can see we that the latest two ships we have spotted has been outside marinetraffic range for 69 and 15 days. Not too bad ...

On the COM part you can see 67 bit errors in 15 bytes that was corrected by our protocols in one packet. Just 1 bit error had destroyed an AX.25 package. Not too bad for error corrective protocols...

A short summary for the evening passes

- ADCS1 had detumbled the spacecraft from a high tumble rate during the night
- AIS1 and AIS2 has been running much of the time, as they are configured to automatically turn on in high power mode (> 7.6 V)
- EPS is working (and charging up till 2.3W from solar cells)
- Temperature now in range 3-8C - which is good
- Very low bit error rate on downlink (more on this later)

- Q : why ?
- A: why not ?

- You are using 1e9 lines of free SW yourself

- If you show me yours I will show you mine (SW & HW)

QUESTIONS ?