Stay on the Path

Sticking to your Selected CubeSat Mission to Achieve Project Success
- Small satellite solutions (1 - 25 kg)
- Vertically integrated space company
  - Research and development
  - Components and subsystem production
  - Satellite mission design and implementation
  - Satellite launch services
  - Satellite operations
- 50 FTE based in Delft, The Netherlands
Fully integrated CubeSat Capability

- Systems Engineering
- Electrical Engineering
- Radio Frequency Engineering
- Attitude Control Engineering
- Embedded Software
- Flight Software Engineering
- Test Engineering
- Project Management
- MAIV Expertise
- Mechanical Engineering
Main Activities

- Standard Products
- Launch Services
- Missions & systems
- Networks & Applications
CubeSat platforms and turnkey solutions
Evolving CubeSat Market

**Changing Applications**
- Education
- Tech Demonstration
- Small Scale Science
- Pre-operational Demonstrators
- Medium Scale science (e.g. Radio Astronomy)
- Near-RealTime Global Monitoring
  - Remote Sensing
  - Tracking and Tracing
  - (Space) Weather
- Telecom (M2M, data backhaul)
- ISIS works on missions projects over the full application range

**Changing User / Customer Base**
- Academia
- Research Groups and SME’s
- Space Agencies and LSI’s
- Startup companies, and Commercial Ventures based on data services
- ISIS supports the full range of CubeSat customers
Change in design approach

• From a low cost educational tool...
  (anything goes)
• ...to a constraint-based, cost-effective LEO demonstrator...
  (live with its limitations)
• ...to a niche market, full-fledged space solution
  (more classical design approach)

... Large risk of mixing or switching design approaches creating programmatic issues
Efficient One-off missions are the challenge
The path to mission success?
The path to mission success?

• The traditional project lifecycle is being challenged due to
  – Shorter project timescales (~6-12 months)
  – Much wider (mixed-experience) customer base
  – Broader risk acceptance range

• In the last 9 years, ISIS has gained experience in working with tens of different one-off missions

• And has been involved in many different flight projects with different customers:
  – Universities and research institutes, commercial companies, consortia, etc.

• Each of these projects has their own challenges but they often share a number of common misconceptions, issues and result in programmatical challenges
Misconceptions – Paperwork is evil
Misconception – off the shelf Hardware

CubeSatShop.com

The one-stop-shop for all your CubeSat and nanosat systems...

Welcome to the CubeSatShop, the one stop webshop that offers a broad range of products for CubeSats and nanosatellites in general. The webshop offers standardized, off-the-shelf components and subsystems from a variety of manufacturers.

Categories

CubeSat Structures  Communication Systems  Power Systems

Attitude Control Systems  Antenna Systems  Command & Data Handling
Misconception – Plug-and-Play
Misconception – Strict CDS adherence

CubeSats: 1 kg (10x10x10cm) to 25kg (22x22x45)

CubeSat Standard still continues to evolve
"The customer is always right," is half a sentence. The rest of it is, "if the customer is reasonable and not an idiot."
Causes for issues – The Customer

• Varying customer type
  – Experience Level In Space Missions
  – Subject Matter Expertise
  – Expectations

• Level of involvement varies
  – Mission Objectives and requirements
  – Requirements creep / scope creep
  – Unclarity on interface responsibility

• Is also subject to various influences
  – Consortia, sponsors and funding bodies
  – Hidden requirements / constraints
Causes for issues – process uncertainty

Idea pops into my head
Go off and do something else. E.g. Watch Doctor Who or bake a cake

Go to bed in the hope and idea will appear before I go to sleep
No ideas turn up

Panic and feel like ripping everything up

Design Process
Receive brief

Jot down initial ideas/mindmap

Research

If not...
Hope something good happens...

Start experimenting with ideas

Success

Develop idea

Development works
Create final outcome
Success!
Causes for issues – process uncertainty

• Funding cycle drives configuration
• Imposed external process
• Requirements creep / scope creep
• Skipping mission definition process
• Review by date, rather than design readiness
• Hidden requirements / constraints
Common results

• Chaos
• Switching design approaches midway the project
• Redoing work
• Delays
• Cost escalation
Common CubeSat Design Process

- Waiting on new budget or descoping of mission
- Skipping the definition phase
- New Requirements appear / Things have been missed
Lessons Learned

- Focus on mission definition and preliminary design
- Don’t take too many shortcuts
- Contractual split between design and implementation phase helps
- Plan for the worst case scenario
- Get all requirements and constraints on the table early
- Educate the customer, educate the supplier
Conclusions

• CubeSat projects do not always use traditional design process
• This causes different issues and different solutions for different projects
• By improving the way these different projects are run, we might actually end up with a process that is more optimal than the traditional process
• But it is important to deliberately choose a certain process and avoid costly pitfalls or changes in design process halfway a project.
Thank you for your attention!

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