A note to future project members

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1 Purpose

As we, the specification development team, are approaching the end of our work, several important lessons have been learned about space engineering. Some of these lessons are particularly valuable, and important to take notice of in order for the project to succeed.

2 Understand the Space Environment

Space engineering brings with it a vast quantity of problems and challenges, many of which never apply to any other form of engineering. It is advised that everyone engaged in the project acquire themselves a good understanding of such problems. All environmental problems may not apply to your subsystem or sensor (or whatever), but don't take anybody's word for it. Find out exactly how your component or system will function when operating. You won't be able to fix it once it's out there. Also remember that things must be launched before they can become satellites.

3 Know what the other guys are doing

We are not NASA, ESA or Hughes. We cannot afford 2000 engineers working with each little component, and a staff of nearly as many people concerned with putting the parts together. Actually, only one or two students might be involved with designing and building each of our subsystems, few of which will have the opportunity to follow the project from beginning to end, and neither of which have been involved in such a project before. By the looks of it, we're screwed. In fact, the only way for this project to succeed is for us to be brilliant engineers, and work together as a tightly involved group. If you dont want to attend meetings, find some other master thesis.

4 Off-The-Shelf

Although this is a low-budget project (extremely low compared to professional standards) we do not need to use the cheapest parts available. The satellite has been estimated to a cost of 150 000 NOK, and each student is allowed a fair part of this for their subsystem. How can a satellite costing 25000$ work as well s one costing a 1B$? The only thing most people know about the space industry is that they use horribly expensive parts. This is because the space industry incoorporates an extremely conservative design method, and compared to them, throwing a Bugatti Veyron into space is extremely cheap (and ueseless). S-class components are special because they are sold only for space applications, meaning a small market and therefore high cost. By using good, off-the-shelf products and testing your module or subsystem until you are absolutely certain of it's success, expensive parts can be avoided. Yes, we now that most subsystems cannot undergo thermal-vaccum tests until they are assembled and mounted in the satellite. But I'm sure you'll be able to get hold of some liquid nitrogen from the physics department, and a regular oven is located at Omega verksted. Do what you can with the means available. By the way, most OTS parts have been tested automatically in production, ensuring very high quality, and they are tested out in their thousands, every day, in all sorts of Earth-based appliances and machinery, ensuring high reliability.

5 Why does satellites fail?

High quality does not neccesarily implicate reliability. Parts failure is one of the least known killer of satellites. Actually, the number one killer of satellites is us, the engineers. If something is designed to go wrong, of course it will! Furthermore, if it's not designed to be idiot-proof, an idiot will tamper with it. Beware of Murphy, he is ever-present in this game. Below follows the most-wanted list of satellite killers:

1. Design Failures

   If things are designed to go wrong, they will. Don't allow the software to execute the command "turn off receiver 1" if receiver 2 is not working. Design your module so that it will withstand being dropped off the table, etc.

2. Human error

   Alhough most failures are due to human error, pay extra care during assembly. If someone has a bad day and forgets to tighten a screw, the whole thing may fall apart during launch. A more disturbing fact is that while we are painstakingly constructing our satellite, some italian engineer might forget a rag in some fuel line in the Vega Launcher, on top of which we will place our precious. Rockets are also buildt by humans....

3. Connections

   Connections are one of our worst enemies. Keep the number of connections and loose wires as low as possible, as they will most certainly fail at some point. Remember that solderings are connections too. Talking about soldering, it will probably be best if we leave it to professionals, or preferably, a machine, at least for the flight-models. Be aware of SMDs, as they are prone to cause problems due to gas residues stuck between the component and the PCB.

4. Environmental misjudgement

   Another human error, this can again be traced back to the design board. Know your surroundings, both the ones in space, aboard the launcher, in the testing chambers and on your workbench. Keep things clean and GROUNDED.

5. Parts failure

   As mentioned earlier, parts failure comes way down the list of notorious killers, partially because parts are subject to intense scrutiny by both manufacturer and buyer. Why should you be less sceptical of them?

6 Good Luck!

We'll all need some of that. But don't rely on it, because many others, including the three of us who started this circus, rely on you to do your job. That is the very special thing about building a satellite. Almost every system has some crucial function, and therefore, all the people involved are equally dependent upon eachother for sucess.

Yours Sincerely,

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