Batteries explosive properties characterization for LEO Satellites

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Introduction

- Batteries are one of basic components in satellite
- Current Lithium-Ion cells have replaced nickel-metal hydride cells
- They are more powerful, radiation resistant
- They have less performance drop allowing them for longer operational life.

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So where is the problem

- Batteries which are subjected to elevated temperature might go into thermal runaway where the cell starts to rapidly get fire and rupture.

- This scenario is catastrophic. Every single debris even small having big velocity might cause permanent damage to other spacecraft.

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Solution

Idea is to design and develop protective chamber/clothing for batteries which will prevent negative results of thermal runaway.

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Approach

- Short term goal: Establish TNT equivalent of Thermal Runaway

- Long Term goal: based on result propose type of protective chamber

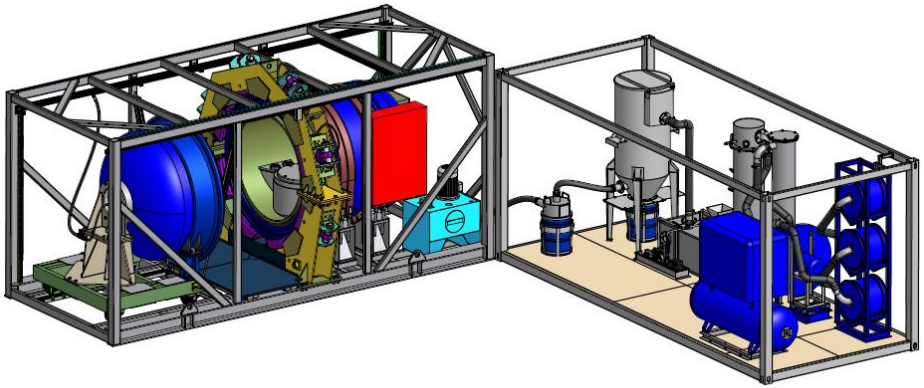
Test plan

- In order to find TNT equivalent first test will be done in inert atmosphere.

- Knowing it final test will be performer in vacuum with witness plate to for having reference

Test setup

All test will be performer in detonation chamber will gas neutralization system



Test setup

However test setup will need to be modified in following:

- Heated table
- Pressure sensor
- Witness hole for camera

Test scenario

Overcharging cells

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Placing them inside detonation chamber on heating plate

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Heating rate 35C/hours

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Heat for 5 hours or until thermal runaway occur

Test subjects

Tested will be 4 cell types from which best and worst will selected for further investigation.

Tested variants will be

- 1 cell
- 8 cell
- 88 cell
- 88 cell in vacuum

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Future development

Having TNT equivalent batteries thermal runaway company will propose contamination unit for LEO satellites up 100kg.

Which will be:

- Lightweight
- Cheap
- Reliable

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Thank You for Your attention