Scenic Overview

My Project--SmallSat Relational Database
SSmallSat Database

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SmallSat Database Research

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Subject Matter Expert: Tom Tanger

Research of Small Sat Hardware, development of database schema, and integration with future SCENIC Capabilities.

Task Activities

Week 1-3 SmallSat Research
Week 4-6 Database Development
Week 7-10 Refinement of Database Schema
Since miniature Satellite Technology is advancing quickly, there is a need to create an state of the art database and it’s tools, which could cross reference small satellites and model them.

1. Research SmallSats
2. Develop a Schema to store smallSat data
3. Work with local subject matter experts to refine the database schema
4. Start data gathering on satellites
Important SmallSat Data
An Idea of Research Information

2. St. Louis Univ. Prof. Swartout database: https://sites.google.com/a/slu.edu/swartwout/home/cubesat-database
3. Earth Observation Portal: https://directory.eoportal.org/web/eoportal/home
10. SSC12-VI-9_presentation.pdf
12. Example_radio_set.xlsx
13. ATT00001.htm
14. ATT00002.htm
17. http://www.aerospace.org/expertise/civil-and-commercial/
18. https://directory.eoportal.org/web/eoportal/home
19. https://sites.google.com/a/slu.edu/swartwout/home/cubesat-database/#database

plus Much More
**Small Sat Radio Catalog**

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>Missions Supplied</th>
<th>Quantity</th>
<th>Encoding</th>
<th>Number Antennas</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-band downlink</td>
<td>ALSAT-1, UK-DMC-1, BILSAT-1, NigeriaSat-1, TOPSAT, Beijing-1, OPSAT, GIOVE-A (ESA), RapidEye (ES), Cnes-1, UK-DMC-2, NigeriaSat-2, NigeriaSat-1, BrazilSat-1 (2014), TenDemoSat-1 (2014), DMHC</td>
<td>31</td>
<td>Convolutional</td>
<td>50 ohm antenna interface (SMA)</td>
</tr>
<tr>
<td>NovaSAR-S (2015/16/17 mission)</td>
<td></td>
<td>1</td>
<td>Convolutional</td>
<td>Multiple antennas (1-4) Supports up to 4 antennas for redundancy and advanced features e.g. Extra visible mode and attitude determination, etc.</td>
</tr>
<tr>
<td>17 to 40GHz X-band and Ku frequency coverage in multiple subbands, Arbitrary waveform modulation/coding</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2.4 GHz frequency hopping spread spectrum modem, which can be optimized for long distance communication over 36 miles (50km)</td>
<td></td>
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</tr>
</tbody>
</table>

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**Small Sat Radio Catalog**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>X Frequency Range</th>
<th>PPS Outputs</th>
<th>GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 to 2.25 GHz &lt; 120 ppm</td>
<td>2.1 to 2.9 GHz &lt; 120 ppm</td>
<td>Up to 4 W RF power using 38 V unregulated supply &lt; 38 W</td>
<td></td>
</tr>
</tbody>
</table>

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**Other Features**

- Multiple frequencies (L1, L2C or L5/ES)
- Arbitrary waveform modulation/coding
- Transmitter:
  - Frequency range: Single frequency in 130 - 160 MHz range (crystal controlled)
  - Receiver Frequency Range: 400 - 450 MHz range (crystal controlled)
SmallSat Database

Configuration and Control Data

- Software Interfaces
- Optical Comm Package
- Hardware Comm Package
- Hardware Power Systems
- Hardware Electronics
- Hardware Antennas
- Transmitter Table
- Receiver Table
Why Small Satellites:
Low priced, highly utilized for research and development

SmallSat Concerns:
Could additional communication links stress current SCaN network capacity?

Small Satellite Information Required for SCENIC Modeling:
✓ What type of hardware is available for communication?
✓ What type of missions / how many missions are utilizing this hardware?

My Project: Small Satellite Database Development
Store all information required to model a small satellite communication link
Approach

1. **Research** smallSats, their parts and their Companies

2. **Construct** a smallSat database which can cross reference all parts in the smallSat industry

3. **Future** Use...
Future Use

Use it...
✓ To **Populate, verify and validate smallSat Database**
✓ To **Construct the tools** to attach it to the SCENIC system
✓ To **Integrate** the SCAN interns **SCENIC Simulation modeling system**
✓ To **keep up with smallSats** currently in orbit and in future orbit
✓ To **build and model smallSats** by their parts and systems
✓ To **Establish the costs** of a smallSat
✓ In a **similar way as the Enhanced SCMM Database** is being used in SCENIC, but for the smallSats.
✓ **And for...**
Possible Future Development

the SCENIC Emulation of SmallSats

The End