Zac Manchester, Mason Peck
Cornell University

Andy Filo
4 Special Projects
The Sprite “ChipSat”

- Gyroscope
- Magnetometer
- Solar Cells
- Microcontroller
- Radio
- Antenna
Why Build Femtosatellites?

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>Aerodynamic Drag</td>
</tr>
<tr>
<td>EC</td>
<td>Eddy Current Drag</td>
</tr>
<tr>
<td>GG</td>
<td>Gravity Gradient</td>
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<tr>
<td>GR</td>
<td>General Relativity</td>
</tr>
<tr>
<td>LZ</td>
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<td>MT</td>
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<tr>
<td>PC</td>
<td>Particle Collisions</td>
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![Graph showing characteristic length vs. gravitational force](image)

- **Moon**: Lunar Gravity
- **Sun**: Solar Gravity
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Why Build Femtosatellites?
Expanding Access To Space
Launch Costs

Estimated Launch Price Per Pound for Commercial GSO Payloads (constant 2000$)

1990 average: $18,158/lb.

2000 average: $11,729/lb.

Year of Launch

Dollars per pound

Space Transportation Costs
Futron Corporation, Sept. 2002
Transistor Counts

curve shows transistor count doubling every two years
Shrink The Spacecraft!

**Printed Circuit Board**
- 3.5 cm x 3.5 cm x 3 mm
- Area = 12.25 cm²
- Mass = 5 g

**Depackaged Components on Silicon**
- 1.7 cm x 1.7 cm x 350 μm
- Area = 2.89 cm²
- Mass = 220 mg

**System on Chip**
- 1.0 cm x 1.0 cm x 25 μm
- Area = 1.0 cm²
- Mass = 7.5 mg
KickSat Mission

Video Courtesy Ben Bishop
KickSat -- Your personal spacecraft in space!
An Open Hardware project in Ithaca, NY by Zachary Manchester - send message

Support

315 BACKERS
$74,586 PLEDGED OF $30,000 GOAL
0 SECONDS TO GO

FUNDING SUCCESSFUL
This project successfully raised its funding goal on December 3, 2011.

PLEDGE $25 OR MORE

Your name on one of KickSat’s panels that launches into space!
Kickstarter Fundraising
A tiny open source open hardware spacecraft project — Read more

Branch: master

Changed antenna feed line traces to 50 ohm microstrips

<table>
<thead>
<tr>
<th>name</th>
<th>age</th>
<th>message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Kit</td>
<td>a month ago</td>
<td>Initial upload [zacinaction]</td>
</tr>
<tr>
<td>Ground Station</td>
<td>9 days ago</td>
<td>Link budget edits [zacinaction]</td>
</tr>
<tr>
<td>Sprite</td>
<td>5 days ago</td>
<td>Changed antenna feed line traces to 50 ohm microstrips [zacinaction]</td>
</tr>
<tr>
<td>.gitignore</td>
<td>15 days ago</td>
<td>Removed old penalized board, fixed all pullups [zacinaction]</td>
</tr>
<tr>
<td>README</td>
<td>4 months ago</td>
<td>Updated README [zacinaction]</td>
</tr>
</tbody>
</table>
Sprite Ground Station
Sprite Ground Station
Range Test

I'm Down Here
Questions?

zrm3@cornell.edu