The CanX-4 and CanX-5 Formation Flying Mission
A Technology Pathfinder for Microsatellite and Small Satellite Constellations

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Mission Overview

• Two identical satellites
  – Less than 7 kg, cubic form factor 20 cm per side
• Launch on Polar Satellite Launch Vehicle (PSLV), late 2013
• Ejected from separate deployment systems on launch vehicle
• Demonstration of autonomous formation flight

<table>
<thead>
<tr>
<th>Performance</th>
<th>Minimum Requirement</th>
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<tbody>
<tr>
<td>Position Control</td>
<td>1 m</td>
</tr>
<tr>
<td>Relative Position Determination</td>
<td>10 cm</td>
</tr>
<tr>
<td>Minimum Relative Distance</td>
<td>50 m</td>
</tr>
<tr>
<td>Maximum Relative Distance</td>
<td>1000 m</td>
</tr>
<tr>
<td>Attitude Control</td>
<td>5°</td>
</tr>
<tr>
<td>Intersatellite Link Range</td>
<td>5 km</td>
</tr>
<tr>
<td>Intersatellite Link Data Rate</td>
<td>10 kbps</td>
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Formation Flying

- Two Formation Types:
  1. Along Track Orbit
  2. Projected Circular Orbit
Along Track Orbit

500 m – 1000 m

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Projected Circular Orbit

Viewed from Earth
Satellite Layout

- S-band Downlink Patch Antenna
- UHF Antennas (2 of 4)
- S-band ISL Patch Antenna
- Sun Sensor (1 of 6)

+Y
+X
+Z

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CanX-4/-5 Payloads

1. Propulsion System
2. GPS Receiver
3. Intersatellite Link
CNAPS
Canadian Nanosatellite Advanced Propulsion System

• Four-nozzle liquefied cold-gas thruster
• Sulfur hexafluoride (SF$_6$)
• $I_{sp} > 35$ seconds
• Thrust range of 10 to 40 mN
• Total $\Delta V \approx 14$ m/s
CNAPS
Canadian Nanosatellite Advanced Propulsion System

CNAPS-02 flight unit

CNAPS model
CanX-4/-5 Payloads

1. Propulsion System
2. GPS Receiver
3. Intersatellite Link

GPS receiver

GPS antenna
CanX-4/-5 Payloads

1. Propulsion System
2. GPS Receiver
3. Intersatellite Link

- Intersatellite S-band radio transceiver
- S-band patch antenna
Environmental Testing

Completed assembly of CanX-5

Vibration testing of CanX-5
Future Work

- Assembly of CanX-4 spacecraft
- Thermal vacuum testing of both spacecraft
- Launch planned for late 2013

UTIAS/SFL Thermal vacuum chamber